MAR 8 1948

ENGINEERING NEWS-RECORD

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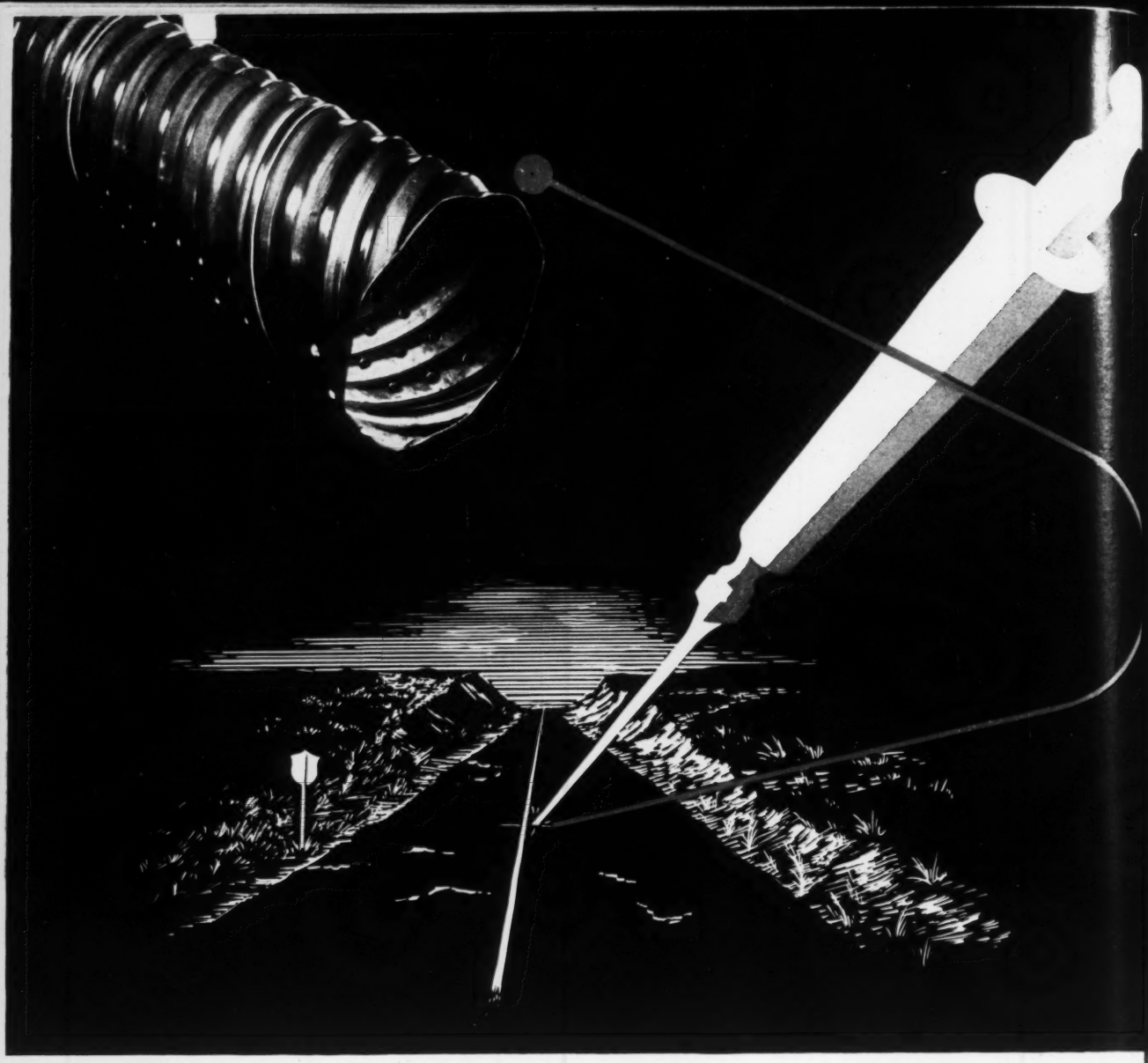
MARCH 4, 1948

Reinforced concrete runway 21-in. thick is placed at the rate of a half-mile a day at Patterson Field

FEATURES·

FINDING AND FIGHTING MARINE BORERS—Part 1

MAPPING SMALL TOWNS



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Durable ARMCO HEL-COR Pipe has holes scientifically placed to collect unwanted water and drain it off along the pipe invert. Subgrades become dry and stable—maintenance costs go down. Made on automatic machines, this pipe meets all the needs of a first-class subdrainage system. It is low in cost, easy to handle and has ample strength to withstand shifting soils, frost action or the impact and vibration of heavy loads.

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Volume 140 • Number 10

March 4, 1948

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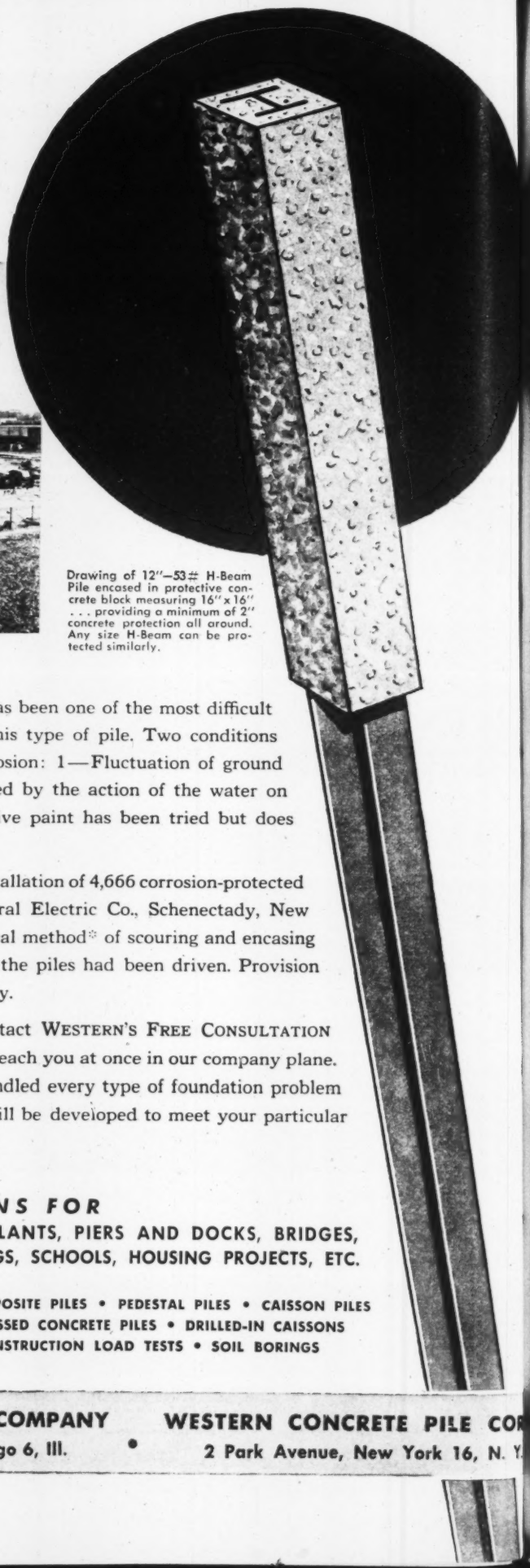
WESTERN'S ANSWER TO CORROSION OF H-BEAM PILES

Photo Courtesy General Electric Co. Cranes are driving corrosion-protection for H-Beam Piles.



Drawing of 12"—53# H-Beam Pile encased in protective concrete block measuring 16" x 16" . . . providing a minimum of 2" concrete protection all around. Any size H-Beam can be protected similarly.

The protection of H-Beam Piles against corrosion has been one of the most difficult problems facing engineers who wished to specify this type of pile. Two conditions subject the upper section of the piles to heavy corrosion: 1—Fluctuation of ground water levels; 2—The highly corrosive acids formed by the action of the water on fill materials such as cinders, garbage, etc. Protective paint has been tried but does not satisfy the requirements of many engineers.

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* Patent Pending.

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Construction Trends

Volume Improves Despite Rise in Costs

The physical volume of construction during the first two months of 1948 rose nearly 5 percent above the corresponding 1947 volume and 15 percent above the 1946 volume. The two-month average of *Engineering News-Record's* volume index, on the basis of 1926 as 100, rose to 90 in 1948 from 86 in 1947 and from the 1946 average of 78. The physical volume index is adjusted for the rise in the trend of construction costs.

The improvement in the physical volume of construction compared with a year ago began in September, 1947 when the *ENR* volume index rose to 112, 14 percent above the corresponding month of 1946. The remaining three months of 1947 continued to show gains over corresponding months of 1946, and the physical volume of construction for the last four months of 1947 averaged 18 percent higher than in the corresponding four-month period of 1946.

The index of the dollar volume of construction, however, averaged 189 for the first two months of 1948, or 18 percent above the average of 160 for the first two months of 1947. Construction costs have now reached a point where more than twice as many dollars are needed to finance construction programs as were required in 1926.

Engineering News-Record's construction cost index, based on 1926 as 100, reached 210.01 in February, a new record high, and was 86 percent above the prewar average of 113.21 in 1939.

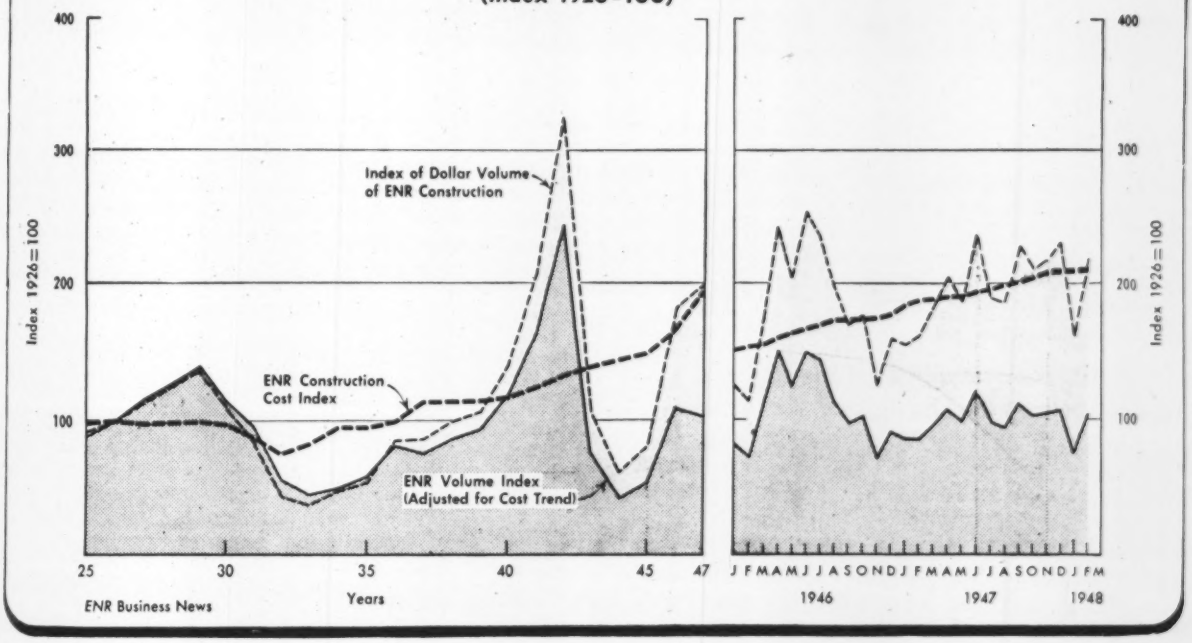
Signs of a slowing down in the rate of increase in construction costs, however, were evident in January and February this year. The *ENR* construction cost index on the 1926 base increased 1.29 points from December to January and .91 points from January to February, the smallest increases recorded since last May.

Rises in the cost of construction have approximated increases in the cost of living. The Bureau of Labor Statistics' index of the cost of food, on the basis of 1935-39 as 100 was 209.7 in January. The index of the cost of apparel was 192.1 and housefurnishings, 192.3. *Engineering News-Record's* construction cost index on the 1935-39 base was 196.14 in January and 197.01 in February.

Thus, the purchasing power of the construction dollar in both January and February was 51 percent of the 1935-39 values. The food dollar was worth only 48 percent of 1935-39 values and the clothing and housefurnishings dollar, 52 percent.

EFFECT OF CONSTRUCTION COSTS ON CONSTRUCTION VOLUME

(Index 1926=100)



ENR Business News

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RYERSON STEEL

New Construction Volume in February

Civil engineering construction volume in continental United States totals $474,643,000 for February, an average of $118,661,000 for each of the four weeks of the month. This average is 34 percent above the average for January, 1948 and 33 percent above the average for February, 1947, according to Engineering News-Record.

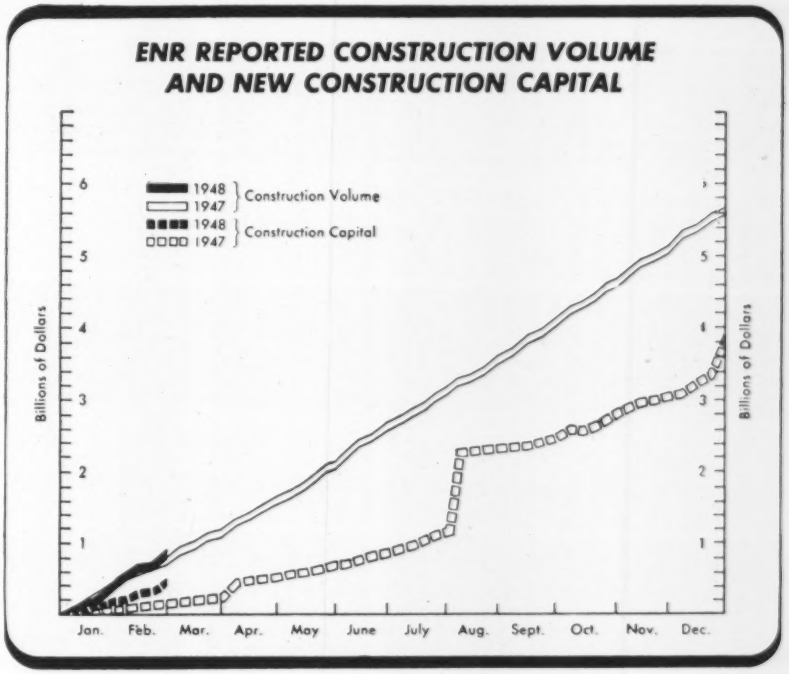
Private construction for February on a weekly average basis is 37 percent above last month but 0.7 percent below February, 1947. Public construction is 32 percent above last month and 94 percent above last February. State and municipal construction is 20 percent below last month but 14 percent above the average for February, 1947. Federal construction, up 199 percent from last month, is 367 percent above February, 1947.

Weekly averages in the various classes of construction for February, 1948 compared with January, 1948 show gains in earthwork and drainage, of 212 percent; private unclassified, 74 percent; industrial buildings, 60 percent; public buildings, 57 percent; commercial buildings, 24 percent; and public unclassified, 9 percent. Losses are recorded for public bridges, of 8 percent; sewerage, 17 percent; highways, 24 percent; and waterworks, 33 percent.

Geographically, four sections showed gains in February, 1948 over January—Far West, 63 percent; Middle West, 47 percent; West of the Mississippi, 28 percent; and Middle Atlantic, 5 percent. South dropped 29 percent; and New England, 50 percent.

Five sections made gains in February over February, 1947—West of the Mississippi, 79 percent; Middle Atlantic, 39 percent; Middle West, 30 percent; South, 7 percent; and New England, 1 percent. Far West dropped 0.3 percent.

New capital for construction for the four weeks of February, 1948 totals $271,012,000, or a weekly average of $67,753,000 for the month. The weekly average is thus 50 percent above the weekly average of $45,170,000 for January, 1948 and 263 percent above the weekly average of $18,648,000 for February, 1947.



ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—FEBRUARY, 1948

Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs—Waterworks, excavation, drainage and irrigation, $28,000; other public works $50,000; industrial buildings, $68,000; other buildings, $250,000*

Four Weeks—Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States February 1948	United States Two Months 1948	United States Two Months 1947	Canada
Public Works										
Waterworks	.....	500	3,324	799	2,851	2,762	**10,236**	**29,326**	19,068	290
Sewerage	.....	669	4,544	416	1,835	2,566	**10,030**	**25,160**	15,956	217
Bridges, public	226	5,101	791	5,963	1,267	644	**13,992**	**32,922**	22,626	263
Earthwork and waterways	2,976	25,856	4,254	1,854	32,323	2,660	**69,923**	**97,951**	21,913	128
Streets and roads	535	7,486	4,517	7,084	12,430	8,073	**40,125**	**105,689**	75,884	3,066
Buildings, public	906	12,179	15,007	15,239	37,088	7,344	**87,763**	**157,581**	81,897	2,919
Unclassified, public	131	2,475	1,387	293	8,474	2,804	**15,564**	**33,430**	41,635	2,712
Total public	**4,774**	**54,266**	**33,824**	**31,648**	**96,268**	**26,853**	**247,633**	**482,059**	**278,979**	**9,595**
Federal government (included in above classifications)	3,224	36,375	13,707	14,307	57,211	9,424	**134,248**	**190,415**	71,945	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Industrial buildings	3,830	11,890	11,955	8,663	8,317	20,482	**65,137**	**116,111**	134,909	7,215
Commercial buildings	9,800	56,554	19,252	10,850	32,285	9,083	**137,824**	**277,123**	325,926	2,165
Unclassified, private	50	50	5,024	3,542	13,457	1,926	**24,049**	**41,305**	47,647	1,400
Total private	**13,680**	**68,494**	**36,231**	**23,055**	**54,059**	**31,491**	**227,010**	**434,539**	**508,482**	**10,780**
Total Engineering Construction:										
February, 1948 — 4 weeks	**18,454**	**122,760**	**70,055**	**54,703**	**150,327**	**58,344**	**474,643**	.....	.....	**20,375**
January, 1948 — 5 weeks	36,571	116,762	98,203	37,099	117,478	35,842	**441,955**	.....	.....	51,296
February, 1947 — 4 weeks	18,291	88,047	65,370	42,184	84,059	58,540	**356,491**	.....	.....	38,345
Two Months — 1948	**55,025**	**239,522**	**168,258**	**91,802**	**267,805**	**94,186**	.....	**916,598**	.....	**71,671**
Two Months — 1947	32,044	225,187	138,338	85,938	158,715	147,239	.....	.....	787,461	76,270

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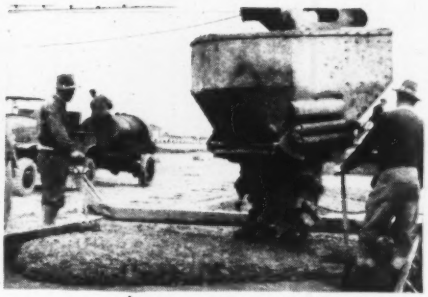

Less mixing water is required for a given slump. Duraplastic mix is more workable, more plastic, more cohesive and more uniform throughout.

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News of the Week

ENGINEERING NEWS-RECORD • MARCH 4, 1948 • VOLUME 140 • NUMBER 10

Engineers' bargaining group sets national convention

West Coast engineering, architectural and scientific organizations ratify constitution of proposed nation-wide bargaining body for professionals

Ratification of a proposed national constitution by five Pacific Coast professional organizations last week automatically activated the new National Professional Association of Engineers, Architects and Scientists—an organization proposing to represent professional employees in collective bargaining actions.

National convention called

A first national convention has been called, to be held in Portland, Ore., March 18-20.

Activation of the association represents one of the first important steps by professional employees to establish an organization to "promote and protect the economic welfare and professional status" of its members. Several local and state-wide groups now exist for this purpose, but they have not succeeded in expanding their activities beyond narrow geographical limits.

The action by the west coast organization culminates almost two years of activity (*ENR* Oct. 17, 1946, vol. p. 487) during which a constitution was drafted and revised with suggestions from seven professional organizations.

Defines professional

As completed for presentation to the national convention, the new constitution defines a professional engineer, architect, or scientist as:

"One who possesses a knowledge of materials, equipment, mathematics and/or the physical and natural sciences, and who applies such knowledge in the planning, design, construction, development, or the use of structures, machines, products, processes or projects; whose work is primarily intellectual and requiring the exercise of judgment, is creative and of such character that the output produced or the results accomplished cannot be standardized."

Work of the association, according to proposed by-laws, will include:

Negotiating contracts with employers operating over a territory larger than that served by any member group (whenever the national association is designated for such work by the member groups); extending assistance to any member group requiring such help; conducting salary and job classification studies on a national scale; assembling and disseminating information concerning activities in collective bargaining and legal developments in that field; and "lobbying and otherwise acting in behalf of" public employees doing professional work.

The convention, expected to launch the organization on a national scale, will also ratify the constitution, elect officers who will include a president, vice-president, secretary-treasurer, and two delegates.

The five ratifying associations, with a total of more than 1,000 active members, are: the Southern California Professional Engineers Association; the San Francisco Area Professional Employees Association; the Engineers Guild of Oregon; a group of Sacramento professional employees, and the Seattle Professional Employees Association. Two others—the Professional Engineering Employees Association of Eastern Washington, and the Southwest Washington Professional Engineers Association—which took part in the original negotiations, have yet to ratify the constitution, but are expected to send representatives to the national convention.

Some of the members have already participated in collective bargaining elections with success. The Southern California organization holds contracts with the Douglas Aircraft Co., and the Southern California Gas Co.; and the Seattle group holds contracts with the Boeing Aircraft Company.

Temporary president of the national organization is Sterling S. Green, of Los Angeles, and secretary is D. B. Slawson, 2135 N.E. 45th Ave., Portland, Ore.

Plan pollution control for S. C. industries

A South Carolina senate subcommittee last week was at work drafting a new industrial stream pollution bill for introduction shortly.

The subcommittee was instructed to draft a compromise bill, after a hearing on a proposed measure developed bitter opposition by the South Carolina Wild Life Federation. This organization centered its attack on a provision that would exempt industries from criminal prosecution for damaging game fish by polluting streams with industrial waste. Federation representatives said that industry should be required to install equipment to purify all waste matter. Representatives of the South Carolina Cotton Manufacturers Association told legislators that such a law would cause damage to industry far in excess of damage to game fish.

Wait Virginia approval on Ohio River cleanup

Only approval by the senate of the Virginia legislature is needed for the start of long advocated cleanup of the Ohio River, the Ohio Basin Conservation Conference was told Feb. 20.

M. Lebosquet, sanitary engineer for the U. S. Public Health Service, told members of the group, meeting at Cincinnati, Ohio, that provisions of the Ohio River Interstate Compact are now being considered by the Virginia legislature. Virginia would be the seventh and last of the states to approve organization to reduce pollution in the river.

The Ohio River program, urged for more than a decade, is regarded by the U. S. Public Health Service as its most ambitious program. Designed to end the dumping of raw sewage in the Ohio and contributing streams, the program would be directed by a 21-member board representing the states.

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Public Construction — Construction will start soon on the $2,000,000 East Tennessee Tuberculosis Hospital in *Knoxville* . . . Ground has been broken for the $1,000,000 Naval Reserve Armory at *Houston, Tex.* . . . *Corpus Christi*, Texas plans a $2,640,000 high school—largest in Texas. . . . Voters in *San Jose, Calif.*, approved a $9,000,000 bond issue to finance a five-year, $19,879,000 school building program . . . The University of Toronto, Toronto, Ont., will raise $6,000,000 for four new buildings. . . .Guy F. Atkinson Co., Long Beach Calif., entered the low bid of $6,295,518 for construction of rotary filters, fertilizer driers and other items in the fifth big contract on construction of *Los Angeles'* new sewage disposal system. . . Work will start in the spring on the $1,000,000 state office building at *Montpelier, Vt.*

Industrial Construction — Three power plants and large expansion of transmission facilities are included in a five-year $25,000,000 construction program of Southwestern Gas & Electric Co. in *Texas* . . . A $5,000,000 shopping center will be built on a 27-acre site in *Dallas, Tex.*, by Angus G. Wynn, Jr. and another similar project at a cost of $2,500,000 will be built in the same city by Will Caruth . . . . . Paraffine Companies, Inc., *Emeryville*, Calif., has announced it will start construction soon on an eastern plant in *Raritan Township N. J.*

Highways — Immediate construction of the first section of a crosstown expressway in *Baltimore, Md.*, has been authorized by the city council . . . Piers for the new Mississippi River bridge at Memphis, Tenn., have been completed by Merritt-Chapman & Scott . . . The Louisville Automobile Club is opposing the proposed $40,000,000 superhighway across *Kentucky*, asserting that there is not enough long-distance auto travel in the state to finance the project by tolls.

Housing—Early completion is expected of a $2,000,000 prefabricated homes project for veterans in *New Britain, Conn.* . . . Houston Town and Country Apartments, Inc., will build a $5,000,000 project at *Houston, Tex.* . . . The Womack Construction Co. has started work in *Phoenix, Ariz.*, on a 265-home project to cost more than $2,300,000.

Miscellany—The city of *Santa Monica, Calif.*, must replace 17.5 mi. of concrete sewer line soon at an estimated cost of $451,000, according to Maurice M. King, city director of public works . . . The sixth and last contract—for $292,950—for the vast sewer project of *Mobile, Ala.*, has been awarded to Joe Reinerton of Miami, Fla. . . . An agreement has been signed at *Houston, Tex.*, raising pay of painters to $1.87½ an hour. . . . A snowslide struck the construction camp at Seattle City Light's Ross Dam in northwest *Washington* state Feb. 16, killing two persons and injuring three. . . . A court order on Feb. 15 ended, at least temporarily, a 10-day strike of AFL Building Trades unionists on $50,000,000 worth of construction projects of the *Los Angeles, Calif.*, city power department. Workers were ordered to end picketing at half a dozen projects.

Push Highway Work—Work crews are going ahead with placing concrete on a stretch of the 4-lane divided concrete highway and part of a 15-mile $6,000,000 controlled access road in Fairfax County, south of Washington, D. C. Said to be the most ambitious road project ever undertaken by the Virginia Department of Highways, the stretch shown above is part of a $1,000,000 contract held by T. E. Ritter Corp. of Norfolk.

Delaware utility plans $17 million expenditure

Construction plans for expansion and improvement projects of the Delaware Power and Light Co. on the Delmarva Peninsula in Delaware, Maryland and Virginia, to cost an estimated $16,991,493 were announced recently.

The largest single item in the program is $5,450,000 for the extension of the generating plant at Vienna, Md., and the installation of a 30,000 kw. generating unit with boiler and auxiliary facilities.

Seek $100 million bonds for Massachusetts roads

The Massachusetts legislature last week began consideration of a bill that would provide for a $100,000,000 state bond issue for highway construction. Bonds would be financed from existing gasoline and auto registration taxes and fees and must be earmarked for use before June 30, 1950.

The bill would permit the state public works department to begin work quickly on a system of main highways, already outlined by the department and the state planning board and the Metropolitan District Commission.

N. Y. newspaper builds rooftop video station

The Turner Construction Co. has started work on a television station for the New York Daily News, atop that newspaper's 36-story building at 220 East 42nd Street, New York. The top of the antenna will be 754 ft. above the street, and the station is expected to provide good video reception within a radius of 40 to 50 miles.

Construction work includes the erection of a 200-ft. steel tower topped by an 80-ft. antenna, and the building of what amounts to an additional two floors on top of the 9-story plant structure on the east side of the building to house television studios.

Architects and engineers for the project are Alexander D. Crosett & Associates. Present plans would put the Daily News station, to be known as WPIX, on the air early this summer. Construction work is being speeded to meet an early completion date.

Concrete problems and progress discussed at annual ACI convention

Meeting at Denver is largest in history of American Concrete Institute—Reclamation Bureau laboratory commands interest

Meeting last week in Denver, the American Concrete Institute chalked up the biggest and best convention in its forty-four-year history, in the opinion of everyone who attended. Biggest it was beyond question, for registration totaled 875. Not since the 1928 convention in Philadelphia, attended by 705, has the Denver mark been approached.

In technical content the program was strong, and representative of the wide interests of the members, without being notable. A major feature that continuously attracted the visitors was the exhibit of equipment and materials set up by thirty-two manufacturers.

To top off its features, the convention's inspection trips included visits to the fine new laboratories of the U. S. Bureau of Reclamation, where a buffalo barbecue luncheon gave the delegates the necessary strength to cover the 103 different exhibits that had been arranged by the various testing groups; and to the Colorado-Big Thompson power and irrigation project and its facilities that are under construction in the vicinity of Estes Park.

Credit for the success of the meeting goes to the local Denver committe of which E. W. Thorson, Portland Cement Association, was chairman, and Robert F. Blanks, chief of the Bureau of Reclamation laboratories vice chairman. Mr. Blanks was elected the new president of the Institute. He succeeds Stanton Walker, director of engineering, National Sand and Gravel Association, Washington, D. C. Frank H. Jackson, U. S. Public Roads Administration, was elected vice president.

At the annual banquet, addressed by Bradley Dewey, president of the Dewey & Almy Chemical Co., on the subject of the Bikini bomb tests, the awards of special prizes were announced. Carl A. Menzel, Portland Cement Association, received the Wason medal for the most meritorious paper, "Apparatus and Methods for the Determination of the Air Content of Fresh Concrete". Treval C. Powers and Theodore L. Brownyard, also of the Portland Cement Association, received the Wason medal for noteworthy research, on the physical properties of hardened portland cement paste. The construction practice cash award went to Richard J. Willson, Bureau of Reclamation, for his paper describing the lining of the Continental Divide tunnel of the Colorado-Big Thompson project.

Although containing no outstanding element, the technical program was substantial and wide in scope, as evidenced by sessions on air-entrainment, prefabricated houses and buildings, and concrete durability, as well as by two papers relating to bond strength. Frank H. Jackson reported on his inspection of the German autobahns this past summer, and Prof. Raymond E. Davis, University of California, described the restoration work on Barker Dam (*ENR* Nov. 13, 1947, vol. p. 650).

ROBERT F. BLANKS

. . . heads American Concrete Institute

A concluding session was devoted to a symposium on a quarter-century of progress in the concrete art.

In this session, a keynote paper by Waldo G. Bowman, editor, *Engineering News-Record* on the subject "Was It Progress, and Was It Enough?" was followed by five papers by acknowledged specialists, all past-presidents of the Institute—P. H. Bates, Roy W. Crum, J. C. Pearson, Frank E. Richart and Roderick B. Young. The conclusion of significant and substantial progress was inescapable, but also enough unsolved problems were cited to keep concrete development active for at least another twenty-five years.

The convention adopted two new A. C. I. standards relating to Recommended Practice for Winter Concreting and Standard Practices for Detailing Reinforced Concrete Structures.

A movement is on foot to develop tabular data to aid in the fixing of sand and water contents and in relating water-cement ratios to strength for mixes using air-entraining agents. This was revealed at a meeting of a subcommittee on air entrainment under the chairmanship of W. H. Price of the Bureau of Reclamation. Tests by the bureau have also indicated that the two approved air-entraining agents Vinsol resin and Darex do not corrode steel; and that they cannot be premixed with calcium chloride or hard waters, even though such combinations can be successfully carried out in the mixer. It has also been shown that the higher the temperature the more agent is required; that the agents improve the sulphate resistance of cement types II and V, but not of others; and that the approved agents reduce concrete strength about 200 psi. for each 1 percent air content in all except lean mixes, where strength may, in fact, be increased.

One agent recently tested, but not yet approved, requires only half as much water in the mix as with the approved agents. It, therefore, causes no loss in strength. It is reported to be of an "expansive" type.

Prefab construction

Evidence of substantial progress in the development and use of prefabricated concrete for houses and industrial buildings was shown at one convention session, principally by a series of movie films. These covered "Cement-stone" construction, "Flexicore" members and so-called "tilt-up" construction in which wall panels are cast flat on the ground and up-ended into place. At this same session Capt. H. L. Mathews (CEC) USN described the extensive use of pumice in prefabricated concrete houses at the Invokern (Calif.) naval ordnance test station. Pumice concrete, prepared in a rotating-paddle mixer, was used in 5-in. wall and 6-in. roof slabs. It weighs only 75 lb. per cu. ft., and has an unusually high insulating value.

Concrete durability

The great importance and present concern with concrete durability was highlighted by a special session devoted to the subject. The role of aggregates was particularly stressed. K. B. Woods, Purdue University, emphasized that the standard sulphate test and the freezing and thawing test are not adequate to predict the durability of certain aggregates. We need new tests, he said, to determine what properties a "bad" aggregate has.

In Kansas, reported W. E. Gibson of the state highway commission, where much of the aggregate used is river sand and gravel, a remedy for some of the resulting poor concrete has been

ACI discusses problems and progress

(*Continued from preceding page*)

found in substituting 25 percent of coarse aggregate, in the form of a soft limestone, to the mix. This cuts down the expansion that previously caused concrete road failures. The explanation is believed to be that the soft limestone absorbs moisture (in contrast to the hard gravel), which is then fed out to the concrete on hot days, reducing volume change.

In reviewing the subject of concrete durability in seawater, Thomas E. Stanton, California Division of Highways, stated four important requirements: (1) the cement and aggregates must be sound as individual materials; (2) the combination of cement and aggregate must be non-reactive; (3) the mix must be designed to produce an impervious concrete, using 6 and preferably 7 sacks of cement per cubic yard; and (4) there must be no segregation or honeycombing.

A sulphate-resistant type of cement is desirable, but even a high-alkali cement can be used and made resistant by air-entrainment or 20 percent puzzolan substitution. The basic requirement, said Mr. Stanton, is to get great density so that no cracks will develop to permit the entrance of seawater salts.

Damage from carbon dioxide

A striking case of concrete deterioration was described and analyzed by Ruth D. Terzaghi, geologist of Winchester, Mass. It involved a gate structure pier, 80x25x48 ft. in dimensions, in one of the submerged shipways built at Newport News, Va., during the war, which showed progressive crack development, accompanied by both vertical and horizontal expansion as well as actual concrete deterioration, when it was about 2 years old. Mrs. Terzaghi, after extensive investigation of the structure, concluded that the high carbon dioxide content of the water surrounding the pier was the destructive element. Coming in contact with the calcium hydroxide of the concrete the carbon dioxide produced a calcium bicarbonate which was carried off in solution in the water. This would account for the deterioration. The expansion, on the other hand, was ascribed to a crystallized deposit on the aggregate surfaces resulting from enrichment of the concrete by sulphite from the seawater. These deposits caused the whole mass of the pier in certain areas to expand and crack.

Two papers were presented relating to the highly important subject of bond resistance of the reinforcing steel. Prof. Herbert J. Gilkey, Iowa State College, reported that the research on the new, improved deformed bars being carried out by the steel companies indicates that important revisions in allowable bond stresses will result. Although the tests have only covered 7/8-in. bars and 3,500-lb. and 5,600-lb. concrete it seems probable that increases in bond stresses of as much as 50 percent may be justified when the bars with higher, closer-spaced deformations are used. However, this will apply only to bottom bars in deep concrete members. Top bars, because of the danger of the concrete settling away from them or of mortar coatings, will not be accorded any increased stress. (Some discussion took issue with this prediction on the ground that concrete placement could be improved to assure good bond on top bars.) Prof. Gilkey also reported that when plain bars are used bond stress will have to be decreased over present values because modern bars are being made with smoother surfaces than formerly.

Postage stamp strain gages

The second paper related to bond indirectly in reporting tests of stress distribution in reinforcing steel. Presented by Douglas McHenry, Bureau of Reclamation, the paper emphasized particularly the utility of SR-4 strain gages in providing a complete record of the stress along the length of a reinforcing bar.

These postage-stamp-size strain gages are cemented directly to the bar before it is encased in concrete. Electric wires lead from each to a recording device on the outside. On the 48-in. long test-beams used by Mr. McHenry, from 5 to 15 gages were attached to the single bar that comprised the reinforcement.

From the tests so far made (only 7 beams as a pilot test) it has been observed that the concrete in the tension zone does more work than is usually assumed, even after cracks extend up to the neutral axis. Apparently the concrete below the axis continues to function by cantilever action. It has also been observed that the stress distribution along the middle third of the beam is more uniform with the higher bond developed by the new deformed bars. This uniformity would tend to reduce the peak stresses which cause a few large cracks in a beam. The use of the SR-4 gages permits determination of the location and magnitude of the maximum bond stress, data which should be very useful in future design.

The concrete used by the Germans in their fine system of dual four-lane highways, is not, as is sometimes reported, better than U. S. concrete, but merely seems to be because of lighter truck traffic and a milder climate than ours. Such was the conclusion of Frank W. Jackson, U. S. Public Roads Administration, who made an official inspection last summer of 1,000 miles of the 2,500 miles that were completed before the war. At the same time, Mr. Jackson concluded from his survey that we should undertake research to determine the possibility of greater uniformity in pavement concrete by reducing the maximum size of coarse aggregate (the Germans used a 1-in. maximum); and that we should look into more effective means of compacting freshly-placed concrete by mechanical means (the Germans used a zero-slump concrete and tamped or compressed it to great density by special machines).

Mr. Jackson found that transverse cracking was the only kind of structural defect that has appeared in German pavements, except for some surface scaling on the Munich-Salzburg section. Elsewhere a lack of scaling is attributed to the absence of layers of surface mortar as found on most of our roads. The Germans utilized a low water-cement ratio of less than 0.45, and all of their aggregates were of excellent quality. By our modern standards their cements were inferior, but Mr. Jackson reserves opinion as to whether they are actually inferior in service. They are coarser and less-hardly burned than American cements.

Congress has approved rent control extension

Congress has approved extension for one month of the rent-control bill passed last year and which continued controls on the construction of amusement facilities, such as swimming pools, ball parks, and similar projects (ENR July 10, 1947, vol. p. 23). The President has also signed the bill (H.R. 5390) as he has asked for extension of the law through March 31, 1948 (ENR Feb. 26, vol. p. 321). The law was due to expire Feb. 29 and the present extension is expected to assist in getting the longer extension.

Little construction has been delayed by the remaining controls. Between July 1, 1947, and Feb. 1, 1948, approval was denied for only 1,800 projects with a total estimated cost of about $80,000,000. The controls are handled by the Office of the Housing Expediter.

Home builders see tight money mart, plan new low-cost and rental housing

National Association of Home Builders hears discussions of industry problems—Plans 1,000,000 units for 1948

Mortgage financing in a tightening market and construction of housing to meet the needs of lower income families led all other topics at the annual convention of the National Association of Home Builders, in Chicago last week.

The builders declared that extension of the government's mortgage insurance program under Title VI of the National Housing Act, and creation of a secondary market to assure liquidity of mortgages would take care of all financing needs without any increase of current interest rates. Bankers who addressed the group, however, held out for an increase in rates as the only effective solution.

Convention delegates said they regard the $10,000-and-up home market as nearly satisfied, and their aim now is to supply the huge demand for houses in the $6,000-$7,000 bracket.

Rental construction prospects

Rental housing continues as one of the chief objectives for 1948. Pointing out that of 834,000 units completed in 1947, 140,000 were for rent, officials said the association will strive for 1,000,000 completions in 1948, of which 40 percent will be rental units. Some speakers, however, contended that both targets are too high. They set 850,000 completions as a more realistic figure for this year, with a higher proportion of rental housing than in 1947.

At the conclusion of the five-day convention, the association adopted a statement of policies summarizing its aims. The statement advocated: that Title VI of the National Housing Act be extended; (2) that Congress designate a government agency to purchase both FHA and VA loans for the term of the veterans housing program without limitation as to the amount discountable by any lending institution in any stated period of time; (3) that Sec. 203 of the housing act be amended to increase the maximum loan to 90 percent on the first $10,000 and 80 percent on the next $10,000 with a maximum loan of $17,000 for houses containing one to four dwelling units.

(Title VI referred to above is the latest wartime addition to the act. It has been carried forward to encourage construction of housing for veterans, and most applications to FHA are made under this title. The present expiration date of Title VI is March 31, 1948, but President Truman has already asked Congress to extend Title VI one year and that federal power to buy home mortgages be transferred to the overall housing office, the Housing and Home Finance Agency.)

Financing problems

Joseph E. Merrion, Chicago builder, summarized the mortgage market situation at one of the sessions. "A serious problem," he said, "is the lack of a secondary market to absorb part of the holdings of mortgage firms, banks and savings and loan associations when an oversupply of mortgages forces these groups to leave the money market. Creation of a government agency to act as a clearing house for excess mortgages would insure a liquid mortgage market."

Three bankers at the same session took exception to Merrion's analysis. John C. Thompson, president of the Mortgage Bankers Association, agreed that "a secondary market is advisable, and a 4 percent rate is sufficient so long as it is higher than the return on completely liquid corporate bonds." The bankers, however, united in saying that a government secondary market would be no cure for a shortage of mortgage money. The bankers were unanimous in the opinion that ample funds are available to support the housing program and supply construction loans.

Low-cost housing took first rank in the discussions. Two sessions of a minimum-house round table offered plans for low-cost homes on 20 going projects and heard details of some 20 others. The consensus was that in general, the minimum house built to FHA standards should be an expansible home of 700-750 sq. ft. The selling price ordinarily should be in the $6,000-$7,000 bracket.

Materials are in better supply, the convention was informed, and production will increase this year on such short items as nails, gypsum board and pipe. Structural steel will continue to be allocated by the producers. Rail transport, however, continues to be a bottleneck.

Need apprentices

More building trades apprentices are needed to carry out a program of 1,000,000 new houses a year, in addition to all other construction, the convention was told. The number of apprentices has increased for 26,000 in May, 1946, to 115,000 today—but 200,000 are required, according to William F. Patterson, director of apprentice training service, U. S. Department of Labor.

Milton J. Brock of Los Angeles, Calif., was elected president for the coming year.

Urge doubling building apprentices

A special industrial committee has been organized under the auspices of the U. S. Chamber of Commerce aimed at nearly doubling the number of men taking advantage of the apprentice training program for the construction industry. The new organization plans to increase the roster to 200,000 trainees, which compares with above 114,000 now receiving instruction.

Because the apprentice training service of the Department of Labor will need to employ some 250 additional field representatives to work with contractors and other groups to carry out the expanded program, the new committee has also appealed to Congress to increase by $2,500,000 the amount of money in the budget for the 1948 fiscal year favored by the budget bureau.

Welton A. Snow, of the building division of the Associated General Contractors, is chairman.

During 1947 more than 830 additional local joint apprenticeship training committees were formed to advance the program. This increase totals over 40 percent of the number in operation as of Dec. 31, 1946, and at the start of 1948 a total of 2,899 committees were operating.

Some 61 branches and chapters of the AGC are now participating in apprentice training programs.

Additional appropriation urged

The Joint Congressional Committee on Housing recently was urged by Douglas Whitlock, chairman of the Building Products Institute, to recommend an additional appropriation of $2,500,000 for the U. S. apprentice training service in order to help avert a shortage of skilled building trades workers this year. Estimates indicate an additional 150,000 to 200,000 needed to meet the 1948 demand.

Paper industry extends waste research

Will spend $100,000 this year, National Council for Stream Improvement tells sponsoring companies

Some $100,000 will be spent for research on pulp and paper mill waste-disposal problems this year, the National Council for Stream Improvement, announced at a meeting in New York City last week. The organization, representing 200 manufacturers of paper products, and 85 percent of the industry, has for several years sponsored investigations on treatment of wastes to reduce stream pollution and recover by-products.

Russell W. Winget, executive secretary, reported that last year $87,000 was spent on research and development. Among the sponsored projects under study at eleven universities and private institutions are: Acid and alkaline bleachery wastes at the Mellon Institute of Industrial Research; strawboard waste at Purdue University; white-water problems at Rutgers University; de-inking at the University of Michigan and Kalamazoo College; stream analysis at Manhattan College; semi-chemical wastes at Virginia Polytechnic Institute; and biological processes applicable to kraft-mill wastes at Louisiana State University.

Federal pollution law not needed

In presenting philosophy of a New England states regulatory agency on water pollution, Arthur D. Weston, chief sanitary engineer, Massachusetts Department of Public Health, commented that the aggravated conditions of stream pollution throughout the country is resulting in a deluge of requests for control legislation.

"The problem of regulation should be attacked in a sane and intelligent manner which will adequately protect the public health, but not make it impossible for industry to survive. This can be solved without federal interference," Mr Weston said.

William M. Weir, sanitary engineer of the Georgia Department of Public Health, said his state based its policy with regard to stream pollution on preventive measures.

Mr. Weir added his disapproval of federal pollution legislation because it would offer no additional "know-how" and only bring into operation another agency to complicate the situation in securing compliance.

Other speakers included: Rolf Eliassen, professor of sanitary engineering, New York University, and C. J. Velz, professor of sanitary engineering, Manhattan College.

***Honor from Britain**—Gordon M. Fair, dean of the Harvard Graduate School of Engineering, holds the diploma of the British Institution of Water Engineers, presented to him by E. Sherman Chase of Boston at recent meetings of the New England Water Works Assn. The award, presented for the first time to a U. S. citizen, recognized Dean Fair's paper on "Hydraulic Investigation of Water Distribution Systems" as an outstanding contribution in the sanitary field.*

Western hydrology group discusses littoral drift

That the littoral drift developed by swells and lesser waves as well as that developed by tides must be considered in the design of groins and jetties was pointed out by R. O. Eaton, Los Angeles District, Corps of Engineers, at the South Pacific meeting, Section of Hydrology, American Geophysical Union, held Feb. 13 and 14 in Berkeley, Calif. He said that drift along coast lines is caused not only by tidal action but by swells and waves with a lesser period and this has an effect on design of ocean structures. Some 150 attended sessions held in connection with the Meteorology and Oceanography Sections, at which more than 30 papers were presented.

An advanced method of preparing isohyetal lines (lines of equal precipitation) where complete rainfall data are not available was presented by Merrill Bernard, U. S. Weather Bureau, Washington, D. C. The records thus prepared are of use in study of reservoir sites and in flood forecasting.

Leonard Longacre, Southern California Edison Co., discussed methods of estimating the reliability of stream flow data where records for only a few years are available. As design of storage reservoirs for power and other purposes many times depends on relatively inadequate data, Mr. Longacre pointed out means of correlating such meager records with data from other streams in the general area that were compiled over a longer period of time.

Select top design for St. Louis memorial

$40,000 prize goes to Michigan architect—Design criticized as similar to Fascist Exposition

The Jefferson National Expansion Memorial Commission last week completed the award of $125,000 worth of prizes for the best designs for a new national monument to honor the opening of the West through the Louisiana Purchase.

The memorial is to be constructed on an 83-acre site on the banks of the Mississippi River at St. Louis, Mo. (*ENR* April 10, 1947, vol. p. 541). Prize money was raised by private subscription and the winning design is subject to approval by the U. S. Department of the Interior.

First prize, of $40,000, was awarded to a team of five contestants, headed by Eero Saarinen, of Bloomfield Hills, Mich. The design calls for a huge stainless steel arch, 590 ft. above the levee, and park treatment of the remainder of the site, although several museum buildings and other structures would be built.

The second prize, for $20,000, was awarded to a group of architects of the University of Illinois who designed a monument in the form of seven pillars, museum buildings and terraced gardens, and the third prize of $10,000 was awarded to an eight-man team of New York architects.

Criticize design

The winning design brought almost immediate objection from Gilmore D. Clarke, New York architect and consulting engineer, who pointed out that the 590-ft. arch bears a striking resemblance to an arch approved by Benito Mussolini for a Fascist exhibition that was scheduled to be held in Rome in 1942.

Mr. Clarke, who is chairman of the National Commission on Fine Arts, pointed out the similarity of the Italian and St. Louis designs in a letter to William W. Wurster, chairman of a seven-man jury that selected the prize-winning design.

Mr. Wurster, approached by newspaper representatives, scoffed at the comparison of the two arches, commenting that the winning design is "just a parabola" and added that "Nobody has any corner on any type of building—this is merely a mathematical form." Mr. Saarinen also denied that there was any significance in the similarity of the two designs, adding that the arch motif was selected to symbolize the spirit of the opening of a "gateway to the west".

Award $22 million VA hospital jobs

Contracts for three large Veterans' Administration hospitals totalling $22,000,000 were awarded during the week of Feb. 16 to 20 by the Corps of Engineers, supervising construction on the projects for the VA.

At the same time, the Veterans Administration issued a report on hospital work done by its own staff.

Largest Army Job—the 500-bed general medical hospital at Little Rock, Ark.—was awarded at $9,792,650 to a combination of S. Patti Construction Co. of Kansas City, Mo., the MacDonald Construction Co. of St. Louis, Mo., and the Manhattan Construction Co. of Muskogee, Okla.

A $6,911,000 contract for the 300-bed hospital at Wilmington, Del., went to the Virginia Engineering Co., Newport News, Va. A contract in the amount of $4,975,123 was also awarded to T. A. Loving Co., Goldsboro, N. C., and Southeastern Construction Co., Charlotte, N. C., for construction of the 200-bed hospital at Beckley, W. Va.

The corps also opened bids recently for construction of a 475-bed VA structure and appurtenances at Wilkes-Barre, Pa., and a 200-bed hospital at Altoona, Pa., but no awards have yet been made on those two jobs. Lowest bidder on construction of the main building of the Wilkes-Barre hospital was Merritt, Chapman & Scott, New York, whose bid was $7,734,968. The same firm was also low on an alternate bid, which included construction of the main building, mechanical and electrical work, and outside utilities in the amount of $11,230,468.

The Mellon-Stuart Co., Pittsburgh, Pa., whose total bid was $5,642,255, was low bidder on the Altoona work.

VA hospital work progress

The Veterans Administration, reporting on work done by its own staff, said three projects were completed in 1947 and a fourth job is now approaching completion. The completed work included:

A 148-bed $1,737,000 addition to an existing VA hospital at North Little Rock, an infirmary with 164 beds, a continued treatment building with 164 beds, and another 164-bed structure were completed by Wm. R. Goss Co., Chicago, as the general contractor.

A main building providing nearly 3,000,000 cu. ft. of space, plus a number of auxiliary structures, including utility buildings, shops, warehouses, and a laundry were built at Lebanon, Pa. John A. Johnson & Sons, Inc., Brooklyn, N. Y., was the general contractor on this $3,000,000 project. A $10,375,000 contract for 564 additional beds at Lebanon was recently awarded to the same firm by the VA.

A main building, providing more than 1,000,000 cu. ft. of space plus eleven smaller structures, have been completed at Tomah, Wis., by the Gust K. Newberg Construction Co., Chicago, Ill. This $4,500,000 development will provide space for 1,172 beds.

At Dearborn, Mich., addition of two large wings to existing structures is virtually complete by F. H. McGraw & Co., Inc., Hartford, Conn. Cost of this construction will total over $3,500,000.

At the start of 1948 nearly a dozen big VA projects were under construction and during this year bids will be opened for most of the other hospitals. The program, which includes 90 new hospitals to provide over 53,000 beds, is expected to go forward so that in the 1949 fiscal year, beginning July 1, some $412,000,000 will be spent on construction of VA hospitals.

All design and construction activities of the VA are under the general direction of F. H. Dryden, assistant administrator, and J. J. Rockefeller, director of VA's construction service.

Allegheny Co. sewer plan to cost $82 million

A report of the Allegheny County, Pa., Sanitary Authority, proposing an $82,000,000 single plant sewage treatment system to be completed in seven years, with more than half of the main interceptor sewers to be laid in the river beds, has been sent to the State Sanitary Water Board for approval.

The plant, on the north bank of the Ohio River, would be located near the east side of the McKee's Rocks bridge.

The annual cost of plant operations are estimated at $4,869,000.

Montana highway bureau names chief engineer

Scott P. Hart has been appointed Montana state highway engineer, succeeding Howard W. Holmes, an announcement at Helena said last week.

Hart has served for some 25 years in the department, rising from instrument man to materials engineer, a position he held before and after World War II.

Mr. Holmes was relieved of the highway engineer post at his own request after seven years' duty and has been made bridge engineer.

Arizona groundwater code delayed

Arizona's efforts to enact a ground-water code (*ENR* Jan. 29, vol. p. 144) stalled in the senate and the fourth special session of the legislature adjourned with the issue unsolved.

Governor Sidney P. Osborn called the session for the specific purpose of enacting a groundwater code to fortify the state's chances of obtaining Federal appropriations for the $738,404,000 Central Arizona project. This would result in the bringing of 1,065,000 ac. ft. of water from the Colorado River into the area.

The legislature was reconvened immediately into a fifth special session to consider an omnibus bill covering 15 other subjects, but Governor Osborn said that upon its adjournment he would call a sixth session to consider the groundwater question.

Governor Osborn had called for a powerful code giving the state all-inclusive power over the drilling of all wells and the distribution of water.

The best the house could do was to submit a bill providing for control of irrigation well drilling on new lands in critical areas below 2,000 ft. This was killed by the senate which then passed a bill declaring a 3-year moratorium on the drilling of wells in critical areas. The house disagreed, killed the senate measure and the session ended deadlocked.

The state's under-ground water table has dropped at an alarming rate in recent years and many thousands of acres lie uncultivated this year for lack of water.

Informed statehouse sources claim the fourth special session's reluctance to pass a groundwater code is part of a legislative deal and that chances for passage of some type of code may be better when the solons are called into a sixth special session.

Arizona water commission begins operation

Operation of the Arizona Interstate Stream Commission as authorized by the fourth special session of the 18th Arizona Legislature has been started in Phoenix, with appointment of a 7-man board and the election of officers.

The commission, whose appointed job is to obtain for the $738,404,000 Central Arizona Project the Colorado River water to which Arizona lays claim, will be headed by Wayne Akin, Phoenix, chairman. R. H. McElhaney, Roll, will be vice-chairman.

House OK's $386 million Army fund

An appropriation of $386,000,000 for flood control work, and nearly $149,000,000 for rivers and harbors operations of the Corps of Engineers was approved by the House of Representatives last week as it passed the War Department's Civil Functions Bill for fiscal year 1949.

The totals are much greater than the amounts provided for the current fiscal year, but considerably lower than President Truman's $663,000,000 budget request (*ENR* Jan. 15, vol. p. 75).

Bill approved by the house provides a total of $321,282,000 is for general flood control construction—a figure that exceeds last year's appropriation but is almost $75,000,000 below what Mr. Truman had sought. A total of $60,000,000 is listed for work on the Mississippi and its tributaries—exceeding last year's money by $10,000,000 but being an equal amount below the fund sought. Other flood control items include an emergency fund of $5,250,000 for work on the Sacramento river in California.

$25,000,000 for Garrison Dam

Largest amounts approved for general flood control are:

Bull Shoals Reservoir, Arkansas, $14,000,000; Garrison Dam, North Dakota, $25,000,000; Fort Randall Reservoir, South Dakota, $16,000,000; Buggs Island Dam, Virginia, $9,000,000; Center Hill Dam, Tennessee, $9,000,000; Wolf Creek Reservoir, Kentucky, $12,400,000; and Allatoona Dam, in Georgia, $8,000,000.

Other large flood control items include: Cherry Creek Reservoir, Colorado, $7,000,000; Clark Hill Dam on the Savannah River, $7,000,000; levees along the Missouri River between Sioux City and the mouth, $8,000,000; Harlan County Reservoir, Nebraska, $7,500,000; Fort Gibson Reservoir, Oklahoma, $6,500,000; Lookout Point Dam, Oregon, $5,000,000; and Bluestone Dam in West Virginia, $5,000,000.

Also: Blakely Mountain Reservoir, Arkansas, $3,200,000; Pine Flat project, California, $3,500,000; the Los Angeles River, $4,138,000; Fall River Reservoir, Kansas, $4,000,000; operations at Louisville, Ky., $3,500,000; work at Kansas City, $7,000,000; Wister Reservoir, Oklahoma, $3,900,000; Detroit Reservoir, Oregon, $3,000,000; San Angelo Floodway, Texas, $4,000,000; and Whitney Reservoir in Texas, $4,000,000.

Big McNary Dam Fund

Rivers and harbors money includes $75,304,000 for construction—a reduction of $34,000,000 from what the president sought—$50,000,000 for maintenance and construction work, and $20,000,000 for operation. Largest items in the construction fund are: McNary Dam on the Columbia River, $20,000,000; Mississippi River, between the Ohio and the Missouri, $8,500,000; Missouri, between Kansas City and Sioux City, $2,500,000; St. Mary's River in Michigan, $3,000,000; and Missouri River at Fort Peck, $3,700,000.

Funds provided for work in the Panama Canal zone consists of $12,499,000 for maintenance and operation, considerable of which will be construction work, and $3,600,000 for sanitation operations.

Complete survey of port for Venezuelan capital

Recommendations for the expansion and reorganization of the port of La Guaira—port of entry for the capital city of Caracas—that would substantially increase the monthly tonnage that could be handled through the port, have been made in a report submitted to the Venezuelan Ministry of Finance by IBEC Technical Services Corporation of New York City.

The report is a result of a six weeks' survey made by a commission of eight U. S. port experts, and was submitted to Dr. Manuel Perez Guerrero Minister of Finance.

The report included recommendations that pier construction be expedited, as well as work on proposed new quays that would add about 31 acres of land to the usable port area. A plan for new transit sheds warehouses, a grain elevator and other improvements is also included.

Senate turns down St. Lawrence project

By a vote of 57 to 30 the Senate last week voted to send the bill (S. J. Res. 111) that calls for completion of the St. Lawrence Seaway and Power Project back to the Senate Foreign Relations Committee for further study. This action, which followed more than a month's debate on the controversial measure, means that the bill probably will not come up again at this session of Congress.

Chairman Dondero of the House Public Works Committee has announced that in view of the Senate action, his group will not hold hearings on a similar bill.

State probes causes of Boston explosions

The Massachusetts Department of Public Utilities has opened an inquiry into the causes of a series of manhole explosions during the past winter that caused considerable property damage and some injuries to passers-by.

To date about a score of explosions have occurred, throwing manhole covers into the air, shattering windows and tying up city traffic.

City engineers, who attached no blame to utility companies that operate the systems in which the manholes are placed, said that the phenomenon was a by-product of one of the worst winters on record in the Massachusetts capital.

Both the Boston Edison Co. and the Boston Consolidated Gas Co., each responsible for nearly 10,000 manholes, have been conducting a joint project for manhole monitoring for some years.

Army engineers close Providence, R. I., office

The Providence, R. I., sub-office of the New England Division, Corps of Engineers, will be abolished on or about March 15, leaving Rhode Island without an army engineer office for the first time in 76 years.

During the war the Providence office occupied an entire floor of the Industrial Trust Building and parts of three other floors.

In the fall of 1946 the Boston and Providence districts were combined under the New England Division office.

C. A. McIlvaine dies; long on Panama Canal

C. A. McIlvaine, whose service with the Panama Canal began in 1904, died in the Gorgas Hospital on Feb. 28 in his 71st year. Although not an engineer, his service on the canal has been so closely connected with the engineers as to warrant recording his passing in these pages.

Mr. McIlvanine started work on the canal as a stenographer for John F. Wallace, the first chief engineer. He continued under John F. Stevens, and when construction was turned over to the Corps of Engineers in 1907, he became chief clerk for Col. George W. Goethals. In 1914 he was appointed executive secretary of the Panama Canal, continuing in that position until his death.

OBITUARY

Dwight Frank Jennings, 62, chief of the Report Section, Rivers and Harbors Branch, Detroit, Mich., District office, Corps of Engineers, died in that city on Feb. 17. A civil engineering graduate of the University of Michigan in 1908, Mr. Jennings spent the major portion of his engineering career with the Corps of Engineers, both in the construction divisions and in the U. S. Lake Survey Office.

Harold G. McGee, 59, Akron, Ohio, civil engineer, and director of the Chamber of Commerce municipal research bureau, died Feb. 13. He was a graduate of the University of Michigan, 1913, and did engineering work for the Ohio and Michigan state boards of health. He was sanitary engineer for the city of Jackson, Mich., and later was with Lucas County, Ohio, as designing engineer. In World War I he was in the Sanitary Corps.

Guy Peter Copp, 48, superintendent of construction for the Barrus Construction Co. of Kinston, N. C., died Feb. 19.

Emmet A. Steece, 78, civil engineer who supervised erection of many federal buildings in Washington, D. C., died Feb. 15 in that city. He began as city engineer of Burlington, Iowa, and from 1906 to 1909 was chief inspector during the construction of the main buildings of the Great Lakes Naval Training Station in Chicago. In 1910 he became a construction engineer in the supervising architect's office of the U. S. Treasury Department and constructed federal courthouses and post offices throughout the U. S. and in Alaska. He retired in 1940.

Capt. Everett Hale Still, 45, USN, retired, who was assistant shop superintendent at the Norfolk Navy Yard and in the Bureau of Ships in Washington, and who was also engineering officer on the Arkansas in the North African invasion and engineering officer on the Birmingham during the Sicily invasion, died Feb. 19 in Arlington, Va.

Samuel Lucas Conner, 70, professor emeritus of civil engineering at Tufts College, Mass., died Feb. 18 in West Medford. Professor Conner was head of the engineering department of the Jersey Central Traction Co. in 1903 and was resident engineer for the Pennsylvania from 1904 to 1909, when he became instructor in railroad engineering at Tufts. In 1920 he became associate professor of civil engineering, and from 1930 until his retirement in 1940, was professor of civil engineering and head of the engineering school.

Joseph H. Fleming, Ohio State University, 1902, and formerly a bridge and consulting engineer in Columbus, Ohio, died Feb. 17.

George B. Elliott, 74, of Wilmington, N. C., former president of the Atlantic Coast Line Railroad, died Feb. 19. He obtained his civil engineering degree from Virginia Military Institute in 1892 and practiced engineering until he joined the railroad in 1896. He was president from 1928 until 1942, and chairman of the executive committee thereafter.

William Henry Kelly, 55, a civil engineer graduate of McGill University, died at Alymer, Que., Feb. 7.

Burton L. Parker, 64, died at Liverpool, N. S., Feb. 7. A graduate in civil engineering of Nova Scotia Technical College, Halifax, he was assistant city engineer of Sydney, N. S., assistant engineer in remodeling of St. Peter's Canal on Cape Breton Island, resident engineer in building of Cabot Trail highway on Cape Breton. As an engineer with the Canadian Air force, he directed construction of airport runways, roads and buildings, at Dartmouth, and Yarmouth, N. S., and Moncton, N. B. In 1945, he became town engineer of Liverpool.

H. Gordon Hinkle, 73, who before his retirement in 1946 was employed as a bridge engineer in the Pennsylvania State Department of Highways, died at Harrisburg Feb. 24. He was first city manager of Altoona, Pa., 1918-21, and from 1922 to 1925 he was city manager of Columbus, Ga.

MAJOR MEETINGS

Mississippi Valley Conference of State Highway Departments, Edgewater Beach Hotel, Chicago, Ill., March 11-13.

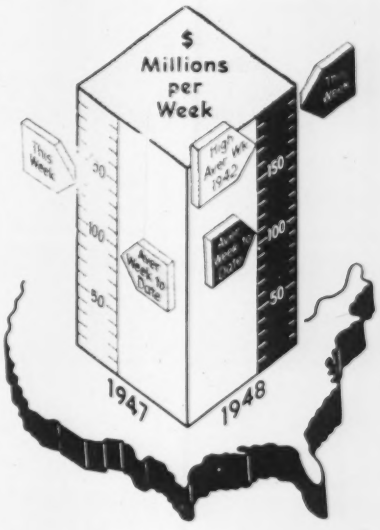
American Concrete Pipe Association, Hotel Roosevelt, New Orleans, La., March 12-13.

American Railway Engineering Association, Palmer House, Chicago, Ill., March 16-18.

National Professional Association of Engineers, Architects and Scientists, Portland, Ore., March 18-20.

Chicago Technical Conference, Stevens Hotel, Chicago, Ill., March 22-24.

CONSTRUCTION ACTIVITY



As Reported this week to . . .
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only
(Thousands of Dollars)

	Week of Mar. 4 1948	Cumulative 1948 (10 wks.)	Cumulative 1947 (10 wks.)
Federal	$56,617	$247,032	$76,741
State & Mun.	55,527	347,171	229,513
Total Public	$112,144	$594,203	$306,254
Total Private	71,728	506,267	609,078
U. S. Total	**$183,872**	**$1,100,470**	**$915,332**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1948 (10 wks.)	Cumulative 1947 (10 wks.)
Waterworks	$2,750	$32,076	$20,037
Sewerage	4,531	29,691	16,781
Bridges	7,669	40,591	27,768
Highways	25,804	131,493	88,499
Earthwork, Waterways	26,416	124,361	23,782
Buildings, Public	42,830	200,411	85,230
Industrial	15,760	131,871	157,280
Commercial	54,377	331,500	350,834
Unclassified	3,741	78,476	145,121

NOTE: Minimum size projects included are: Waterworks and waterway projects $28,000; other public works, $50,000; industrial buildings, $68,000; other buildings, $250,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1948 (10 wks.)	Cumulative 1947 (10 wks.)
NON-FEDERAL	$571,924	$208,100
Corporate Securities	327,942	20,195
State and Municipal	243,982	187,905
Total Capital	**$571,924**	**$208,100**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	Feb.'48	436.89	210.01
Building Cost	Feb.'48	329.71	178.23
Volume	Feb.'48	234	103

EDITORIALS

VOLUME 140 NUMBER 10

March 4, 1948

Marine Borers Versus Piles

THROUGH THE AGES the leading material for ocean-front structures has been wood. Developments, such as new materials or increased availability of concrete or steel cannot be expected to eliminate wood from this important position in the foreseeable future. This is especially true of the ports that must be developed as outposts of an expanding foreign trade. Outstanding among the problems concerning wood for ocean structures is that of protecting it from borers and other marine organisms that penetrate it for food or shelter and, incidentally, consume its strength. Marine structures of timber meet no better agency of destruction than these wood-eating mollusks and crustaceans. That fact gives special significance to the series of four articles by Robert D. Chellis on marine borers and how they work which begins in this issue. From widely scattered sources and a mass of confusing detail Mr. Chellis has selected and set down in concise form the basic information that should be in the hands of every engineer or contractor who plans to build marine structures in sea water.

Runways of the Future

CONSTRUCTION OF A RUNWAY 21-in. thick at Patterson Field, Ohio, to carry a 300,000-lb. plane supported on two wheels, raises the question whether the time is not already past when some authoritative agency should tell plane builders that they must perfect landing-gear designs that will give lower wheel-load concentration if they see the need for still heavier planes. A few track-type or multiple-wheel landing gears have been developed but they appear to be still in the experimental stage. And little further progress can be expected so long as plane builders can avoid the cost of load-distributing landing gear by the simple process of telling airfield designers that heavier runways are required for the bigger commercial planes they plan to build to obtain a greater ratio of pay load to total load and to reduce their ton-mile costs. There is a close parallel to this in our highways, where all states have set upper limits for truck wheel loads in order to keep a small number of truck operators from destroying thousands of miles of highway with surfacing not designed to carry such high loads. Airfield runways can be destroyed in a similar manner, and much of the present investment in runways for our larger airports can be made obsolete because of the lack of wheel-load regulations.

Cooperation for Economy

IT IS CHEAPER to tear up plans and make a new start than it is to tear out construction already in place. Recognition of this obvious fact is seen in the large amount of office planning of construction details now being done on current jobs. However, obtaining the most economical execution of a plan calls for enthusiastic cooperation of the foreman who must put it into effect. Such cooperation can best be secured by incorporating in formal drawings the ideas of the foreman secured by making contact with him in the field. There he is willing to talk and to make the rough, practical sketches for which foremen are noted. Revision of plans to utilize these field ideas makes the foreman feel he has had a share in the planning. Then it is his idea to be *made to work* rather than just a design to be followed. Cooperation and mutual confidence thus established will help in many job problems.

Significant Step in Sewage Treatment

SEWAGE TREATMENT PRACTICE has been benefited as a result of plant-scale experience with the "step" method of operating the activated-sludge process at New York's Bowery Bay disposal plant. This work, reported on p. 81, shows that in the secondary system: (1) biochemical oxygen demand can be reduced about 90 percent with loadings two to three times heavier than normally handled by conventional operation; (2) flexibility in meeting shock loads is provided; and (3) air requirements may be as low as 50 percent of that required under standard aeration. These findings point to decreased costs and improved sewage purification. Economies may be effected both in construction and operation of new plants, and perhaps, with some remodeling, old plants may be increased in capacity as well as made more efficient. In addition, because of adjustability in feeding primary effluent to various passes of an aerator, plant operators are equipped with the means to cope with sudden changes in volume or strength of incoming sewage. "Step aeration" represents a significant advance forward in activated-sludge treatment methods.

James H. McGraw—Pioneer Publisher

IT IS DIFFICULT for readers of technical and business magazines of today to appreciate the special debt they owe to James H. McGraw, founder of the McGraw-Hill Publishing Company, whose death was recorded in these pages last week. To do that even in a small way, one must go back into dusty library shelves to examine the trade publications of 50 or 60 years ago. With few exceptions they were magazines of small value, published primarily for the revenue from their advertisements. Editors were considered a dubious expense, and editorial content was made up chiefly of what "came in over the transom."

Mr. McGraw started his career as a teacher, and it may be that this background brought home to him in later years, when he was a salesman for *The American Journal of Railway Appliances*, an appreciation of the valuable service that a journal might render if it were made a source of authoritative information. And his business acumen told him that it would be easier to sell advertising in a journal that had established itself as an authoritative and influential voice for the industry it served.

Mr. McGraw also recognized that to render real leadership a journal must foster progressive developments. At the time he acquired an interest in *Street Railway Journal*, electric propulsion was just beginning to be offered for street cars in place of horses. He envisioned its great possibilities and despite the opposition of old timers on the staff, insisted that the *Journal* advocate its adoption. Ultimately, he changed the name of the journal to *Electric Railway Journal*.

FOR THE EDITORS of that journal and for the journals he later bought or started, Mr. McGraw laid down the policy that they were to seek and publish significant information about their industry, interpret the news of the industry and promote sound developments. He also insisted that the editors take an active part in the associations or technical societies of the industry or profession that they served and that they spend much time in the field developing information at its source. "Wear out your shoe leather, not the seat of your pants" was a characteristic dictum.

Mr. McGraw would be among the first to deny that he was alone in promoting enlightened publishing policies with respect to editorial content, advertising and circulation building. Among his contemporaries, John A. Hill and Horace M. Swetland also were beginning "to understand that business succeeds according to service rendered", to quote Mr. Swetland. And it is with a certain justifiable pride that the editors of this journal record the fact that the men who founded *Engineering News* and *Engineering Record* George H. Frost and Henry C. Meyer created those journals primarily to render a needed service.

Because of the parallel thinking of James H. McGraw and John A. Hill it was natural that the Hill and McGraw organizations should find much in common, despite the keen competition between such journals as *Engineering News* and *Engineering Record*. This common interest resulted in formation of the McGraw-Hill Book Co., in 1909; and when the Hill publications lost their leadership through the sudden death of John A. Hill in 1916, their acquisition by James H. McGraw, through the formation of the McGraw-Hill Publishing Company, became a foregone conclusion.

THE HIGH STANDARDS that Mr. McGraw set for his publications a half century ago had been widely accepted before he relinquished active direction of the company. By that time, his influence had gone far beyond his own publications and he lived to see greatly improved service being rendered to every major industry in this country.

In large measure, the success of James H. McGraw lay in his native skill as a leader, in his ability to appraise men and his willingness to delegate authority. Once he had made up his mind that he had found the right man to be editor or business manager of a paper, he gave him the reins. Among his legacies to those who carry forward what he laid down, none is greater than his philosophy that men, not paper and ink and fine printing, make a publication great, and that the publication's future depends on the vision, independence, high standards and devotion of those men to the field their publication serves.

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Finding and Fighting Marine Borers

Robert D. Chellis
Structural Engineer, Stone & Webster Engineering Corp.,
Boston, Mass.

• A major concern of the ocean builder in timber is the protection of structures against marine borers. These sea vermin in a few months or years can render useless the most careful calculations of pile-bearing power and strength of framing by consuming the under-water wood itself. The pest exists in all oceans. Some harbor or shore waters are comparatively free, others are thickly infested, and waters at one time free may become infested or infested waters become free. At no time, anywhere, can the builder be sure of complete or continuing safety. He must provide defense, or risk destruction of his works.

• It is not only in modern times that the marine borer has been a recognized scourge. It was known and written of by the Greeks, Phoenicians and following seafaring peoples up through the years, and such defense as could be thought of at the time was undertaken. But it is modern research that gives us the first precise information. The records are voluminous but widely scattered and not generally available. From a search of this source material and by personal observation and inquiry the writer has assembled the known facts about marine borers, their methods of attack and the means undertaken to prevent their depredations.

• These facts are set down in this series of articles. Part I gives identifying descriptions and illustrations of the common borers and of the manner in which timber is destroyed by their action. Succeeding articles outline factors affecting borer activity and habits. Natural resistances of various woods are discussed. The various armors and protective coatings used in the past and at present on wood piles are reviewed and evaluated. Creosote treatements are described. Poisons and other lethal agents are considered.

Part I—Destructive Borers and How They Work

PRINCIPAL point of attack for marine borers is between water level and mud line on submerged timbers. Submergence conceals action of borers, especially of those that enter by pinpoint holes and grow as they consume the inside wood. It is to the pile support of sea structures that marine borer attack is most destructive, especially as complete failure of the structure often is the first notice of any activity. For these reasons, discussion of ways of finding and fighting marine borers are centered on piles but apply equally to other submerged but unprotected structures.

This series of articles is strictly factual and detailed. It is not presented for cursory interest and attention but as a reference primer of facts attested by research and experience. Massed facts are presented in place of generalities. In place of naming the habitat of marine borers as all the seven seas, the reader is informed what borers inhabit what seas. The writer has gathered these facts for his working needs and they are offered here for the similar needs of other engineers.

The predatory borers

The marine borers most damaging to ocean timberwork are mollusks, related to oysters and clams, or crustaceans, related to lobsters and crabs. They are of a dozen genera in which several hundred species have been described. Identification of species is usually a task for the expert. The most important genera of molluskan borers are:

Teredo or "shipworm." Fig. 2, has a wormlike, slimy gray body with the shells used for boring protruding from the head. Two unequal siphons, like a forked tail, project from the burrow. A pair of paddle-shaped or plumose pallets near the siphons are used as plugs to close the burrow against intruders or undesirable elements in the water. *Teredo navalis* varies from $\frac{3}{8}$ in. dia. and 6 in. long to 1 in. dia. and 4 to 6 ft. long. In Pacific islands specimens 3 in. dia. and a number of feet long have been found. *Bankia* closely resembles *Teredo* but runs larger, commonly growing to 1 in. dia. and 3 or 4 ft. long. *Xylophaga dorsalis* resembles *Teredo* but has no pallets. *Lyrodus* is also a shipworm. All worms in *Teredo* bores are not *Teredo;* Pterochates are worms that live on dead *Teredo* but do no damage.

The remaining molluskan borers to be noted are more pleasing in appearance, resembling clams and having bodies entirely enclosed in the bivalve shell.

Pholadidae are a serious menace as they make holes up to $1\frac{1}{2}$ in. deep in the hardest woods. *Pholadidae* have stout shells roughened for drilling. They gain entrance by opening and closing their shells rapidly abrading the wood and making the small entrance hole needed when young. Some species bore in mortar or con-

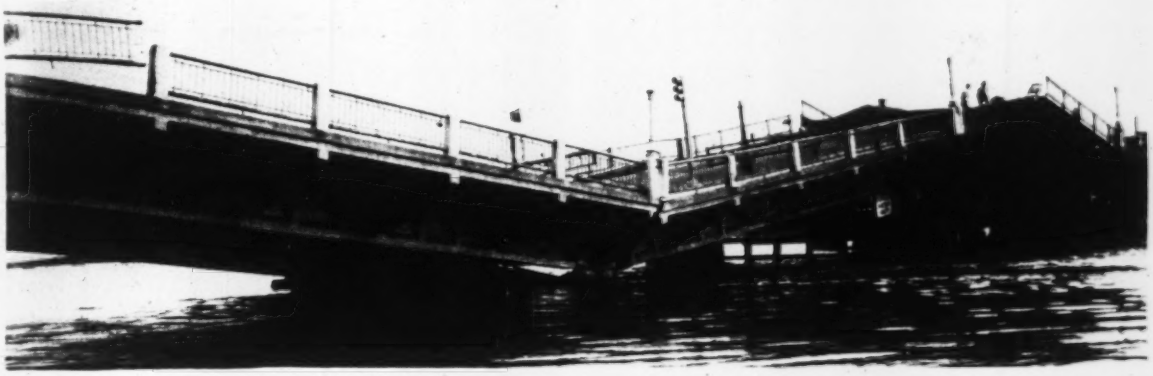


Fig. 1. Bridge collapse resulting from Teredo and Limnoria damage to undertreated piles exposed by scour, Brielle, N. J.

crete, as shown by Fig. 3, although stopped by rock aggregate. Their bores are unlined.

Martesia is shown by Fig. 4. It bores holes up to 1 in. dia. but generally not over 2 or 3 in. deep. It can bore in the hardest wood. *Hiata* resembles *Martesia* but is smaller. *Lithophaga* has no structure by which it can scrape or bore but it secretes a substance that has a solvent action on rock. It has been observed boring in wood.

The crustacean borers of note—*Limnoria*, *Chelura* and *Sphaeroma*—are vicious destroyers. *Limnoria lignorum* is the common gribble or sea louse, the most widely distributed species of crustacean. Dorsal and ventral views are shown by Fig. 5. The body is slipper shaped from ⅛ to ¼ in. long and one-third to one-half as broad. It has horny boring mandibles, two sets of antennae and seven sets of legs with sharp hooked claws. It can roll itself up into a ball and can swim, jump and crawl. In spite of its shape it is sometimes known as the "surface worm".

Chelura is allied to sand hoppers and is slightly larger than *Limnoria*. The joints in the body, the antennae and the legs are heavily feathered with long hairs. In the male the terminal segments of the last pair of legs are developed as two long smooth, stout, club-shaped structures nearly half as long as the body, which are used to block the burrow. A long, curved pointed spike projects from the back of *Chelura terebrans*. *Chelura insulae*, Fig. 7, have longer antennae, enormously large front claws and no dorsal spike.

Sphaeroma and *Exosphaeroma* are

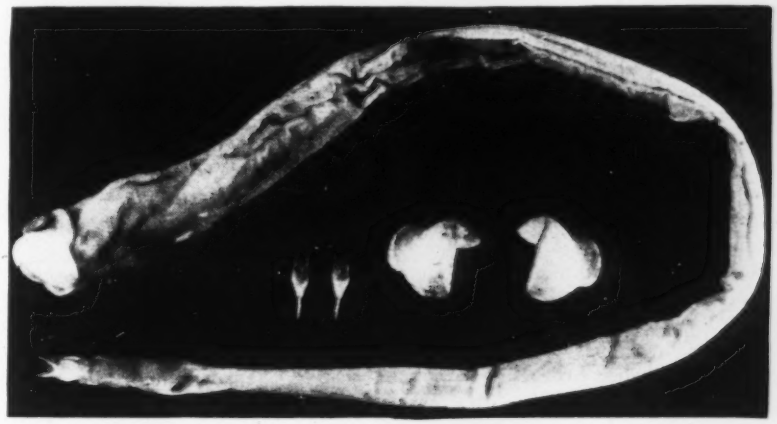


Fig. 2. Teredo navalis or "shipworm" showing the boring shells detached.

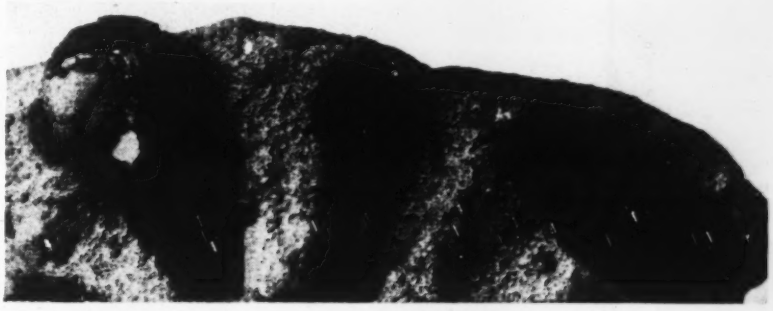


Fig. 3. Pholadidea showing burrows in concrete pile encasement.

Fig. 4. Martesia, a surface borer resembling a clam.

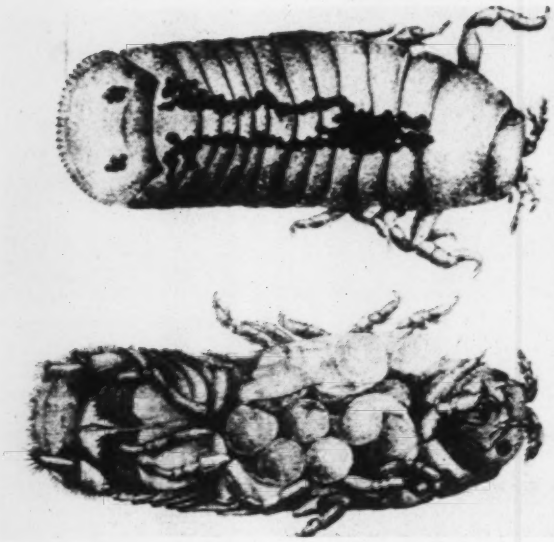


Fig. 5. Limnoria lignorum or "sea louse," the most common crustacean borer.

Fig. 6. Untreated Douglas fir piles "hour glassed" by the attacks of Limnoria.

sometimes known as pill bugs from their habit of rolling up into a ball when disturbed. *Sphaeroma pentodon* is similar to *Limnoria* but is larger, being up to $\frac{1}{2}$ in. long and $\frac{1}{4}$ in. broad. It is much broader in proportion to length than is *Limnoria* and is more oval in shape. It is dark olive to slightly reddish brown often mottled with lighter and yellowish areas in the middle of the back.

How marine borers work

Borers of the molluskan and the crustacean groups have different methods of attack. Those of the molluskan group bore tiny entrance holes when young and grow to size inside, destroying the wood as they grow. Molluskan attacks can be detected only by cutting the wood or by most careful surface inspection. The crustacean borers destroy the surface of the wood and attack is visible from the outside. Because they may easily remain undetected, molluskan attacks are capable of being more dangerous.

Illustrations and descriptions of borer destruction and of how the different borers work follow.

Teredo navalis enters the wood horizontally in minute holes as small as 0.008-in. when made but increasing up to 0.03 in. dia. It usually turns down immediately and expands in 1 or 2 in. to full diameter. Fig 8. Underwater wood is covered with a slimy coating of algae and other organisms and the closest inspection with a hand lense is necessary to detect the entrances. There is nothing to indicate on casual observation the extent of damage inside the pile. Fig. 9. The entrance can be fully closed by the creature's pallets. The burrows are lined with thin walls of nacre, which scales off readily. The burrows may turn to avoid crossing, or twist abruptly; or the borer may withdraw and start a new route. Minor deviations are noted but not to the same extent as for *Bankia*. The burrows have no cross ridges or middle partitions as for *Teredo norvegica*. Attack at some locations is heaviest at the mud line and at other locations is confined to the between-tide area. *Teredo* burrows have been found to extend quite a few feet above the high-water line.

Bankia setacea burrows enter at about pinhole size and turn obliquely, generally down, and enlarge to $\frac{1}{4}$ in. dia. within 2 in. and to $\frac{3}{8}$ in. or $\frac{1}{2}$ in. dia. within 4 in. It does not restrict itself to sapwood and often bores obliquely before turning to run with the grain so that surface samples may not reveal the extent of infection. Burrows up to $\frac{3}{8}$ in. dia. and 30 in. long have been found in San Francisco Bay. The burrows, nacreous lined, penetrate deeper than those of *Teredo* in light infections while in heavy infections all go toward the center. The burrows show minor deviations from the straight or curved routes of *Teredo*. *Bankia setacea* makes longer burrows and bores faster but the burrows are farther apart so that the wood is not fully destroyed. However, their attack may equal the worst *Teredo*.

Fig. 7. Chelura insulae common in Samoa and Hawaii may not be destructive.

Fig. 8. Sections of piles infested by Teredo showing characteristic attack inside the surface.

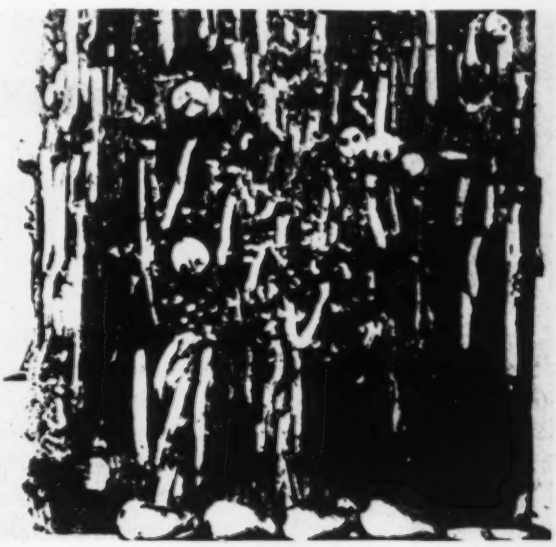


Fig. 9. Test block after twelve months attack by Teredo and Martesia at Pearl Harbor, Hawaii.

Teredo and *Bankia* include the most destructive molluskan borers. The others are essentially surface workers as already described. Of the crustacean borers those of most concern are of the genera *Limnoria*, *Chelura* and *Sphaeroma*.

Limnoria destroys piles by gnawing interlacing branching holes in the surface, as many as 200 or 300 in a square inch. Fig. 10 is a notable picture of *Limnoria* attack. The burrows are 0.05 in. to 0.025 in. dia., seldom over $\frac{3}{4}$ in. long and follow the softer wood rings. Thus the surface $\frac{1}{8}$ in. to $\frac{3}{4}$ in. is left a mass of thin walls between burrows which break away and expose a new surface to attack. This makes the cutting in a repeated process reducing the pile diameter.

Limnoria can burrow into soft woods such as pine and spruce to a depth of 1 in. a year and thus reduce the diameter of a pile 2 in. a year in severe attacks. They work at all levels between mud line and high water but they are usually most active below low water, sometimes at the mudline. The borers will attack in other than the preferred zone if that becomes unavailable. If fill is placed around the piles up to the low water line, which may have been the limit noted for damage, it is to be expected that attack will occur above that point. The manner in which infested piles are cut down and finally break off is shown by Fig. 6. These piles were untreated Douglas fir; the sound piles shown are replacements. The small size of this borer is deceptive, when compared to its destructive power.

Chelura burrows appear much the same as do those of *Limnoria*. It now seems to have been proved that *Chelura* drive *Limnoria* out of their original burrows and occupy them, being blamed for the destruction caused by *Limnoria*.

Sphaeroma pentodon makes round openings up to $\frac{1}{2}$ in. dia. of characteristic size, separated location and appearance. It enters horizontally then turns abruptly and runs with the grain in the softer wood but does not expand. It works principally between tide levels but is found at all depths. It gives the wood a pitted appearance showing large, dark, open burrows with sometimes occasional channels in the surface in deeper submerged parts.

Identification of dangerous borers by their appearance and by the appearance of their work can be indicated only in general terms. Precise determination calls usually for an expert. In many waters the prevalent borers are already known. This information will be given in Part II—Geographic Range and Natural Controls.

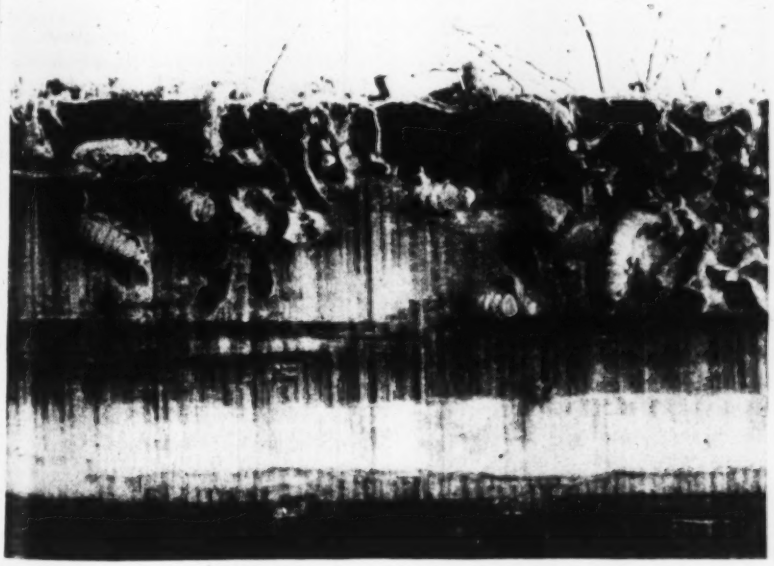


Fig. 10. Limnoria attack, unusual view showing the pests at work.

Street Maps for Small Towns

Lester F. Dingman
Topographic Engineer
Silver Spring, Md.

Contents in Brief—Streets maps for small cities and towns are not only desirable but also indispensable when municipal expansion or utility construction are under consideration. Pointing out that the preparation of such maps is often prohibitively expensive, the author describes a method for making street maps from topographic plats of the U. S. Geological Survey. The process consists of enlarging the area selected photographically to the exact scale desired, tracing the enlargement, and adding the names of streets and prominent structures after checking improvements made since publication of the original map.

MANY TOWNS and small cities have gone without street maps because it has not been financially profitable for the commercial map companies to produce them. Nevertheless, the need for an accurate map showing geographic and other physical conditions is not only desirable but also essential as a basis for planning municipal expansion.

The cost of the necessary field surveys for making a city or town map frequently is so high that public officials are discouraged from having this work done. However, a means exists whereby, for many sections of the country, reasonably accurate street maps may be prepared at very little expense, and the making of such maps presents an opportunity to the local independent surveyor. The topographic maps of the U.S. Geological Survey provide a valuable source of basic information, and a method of preparing large scale street maps from them is described herewith.

No originality is claimed for this method, a detailed report on which was made in 1945 (*Map Making in Three Easy Steps*, Louis H. Smith—A pamphlet published by the Massachusetts State Planning Board). This article is merely an attempt to bring it to the attention of land surveyors in general. It must be emphasized that the maps made by this method will be no more accurate than the small-scale topographic maps which are used in the process. These maps cannot be looked on as a substitute for the large-scale city maps based on careful surveys. However, their general utility and low cost does make them worthy of consideration.

How to start

The first step is to determine whether or not topographic maps are available for the city in which you are interested, and, if so, what are the scale and date of these maps. If the date of survey is sufficiently recent so that extensive revision is not required, then the map can be used satisfactorily in this method.

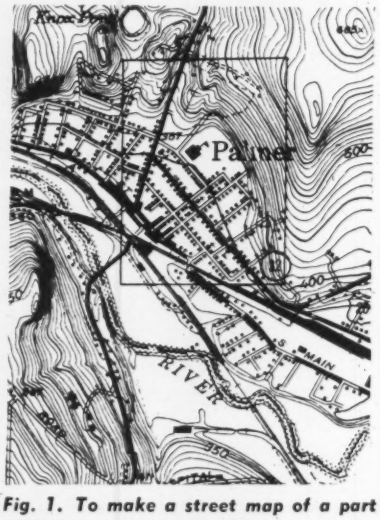


Fig. 1. To make a street map of a part of Palmer, Mass., the first step is to delineate the area to be reproduced on a U. S. Geological Survey Map.

In addition to the standard topographic maps, photographic copies of the original drawings may be available. The use of aerial photographs in modern mapping requires that the original drawing be made at comparatively large scales ranging from 1:5,000 to 1:15,840. Copies of these drawings, if available, make a better starting point than the published maps since, due to their larger scale, less enlargement will be required.

The Geological Survey has recently been authorized to sell photographic copies of map manuscript material to the public. Information as to the availability of published maps or photographic copies may be obtained by writing the Map Information Office of the U.S. Geological Survey in Washington.

When the necessary topographic sheets are assembled, the area which the street map is to cover must be selected. In some cases the corporate limits will provide the logical boundary; in other cases, the immediate suburbs may be of sufficient importance to warrant inclusion in the map; or in some areas— such as New England—it may be advantageous to show only the more thickly-settled portion of the town.

For purposes of illustration in this article, a small portion of the town of Palmer, Mass. was chosen. In Fig. 1 an actual size reproduction of a portion of the U.S. Geological Survey topographic map of the Palmer quadrangle, scale 1:31,680, or two inches to the mile, with the area to be enlarged outlined is shown.

Map scale to be adopted

Choice of a scale for the map will be governed by the extent of territory to be mapped, the desired sheet size, and the reproduction medium available. In choosing a scale, it is wise to select one that is convenient and workable, such as 500, 800, or 1,000

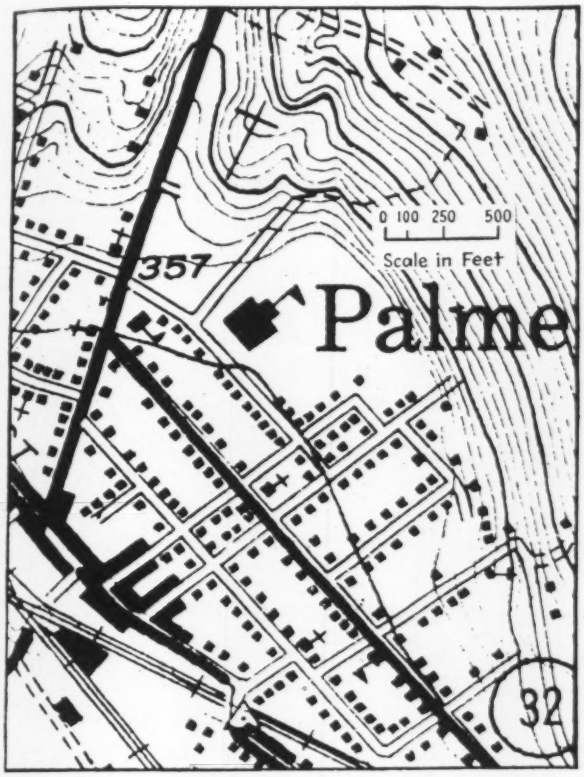


Fig. 2. Made so that the scale will exactly equal 500 ft. to the inch, a photographic enlargement of the selected area serves as the original drawing.

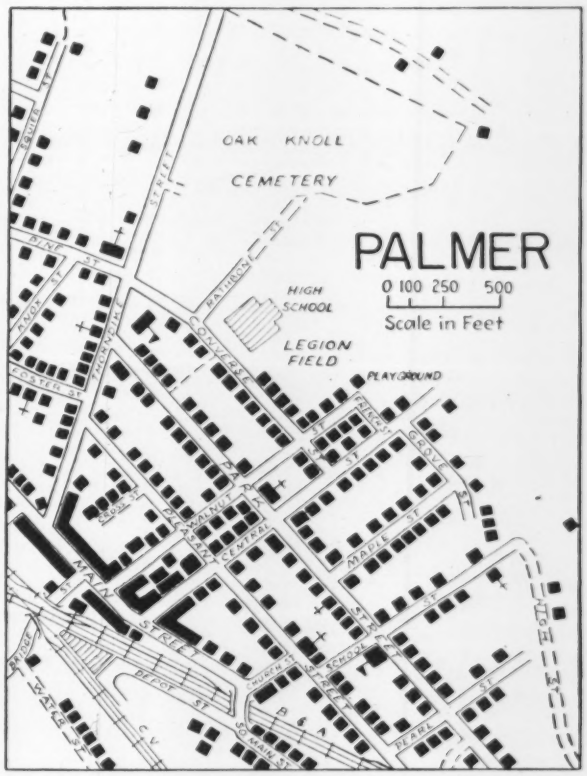


Fig. 3. The finished map is made by tracing the enlargement shown in Fig. 2, adding street names and new structures, and blocking out the title.

ft. to the inch. Odd scales are impractical, since measurement of distances is difficult.

When the desired scale has been chosen, the selected portion of the topographic map should be enlarged photographically. Care must be taken in instructing the photographer as to the exact enlargement required, in order to insure true scale. In Fig. 2 the portion of the map outlined in Fig. 1 has been enlarged to the scale of 500 ft to the inch.

When the photographic enlargement has been prepared, the final drafting can be done on tracing cloth or grained acetate placed directly over the print. If the amount of enlargement has not been very great, it may be advisable to exaggerate width of roads and streets, but care should be taken to center them on the original center lines.

The amount of detail to be shown will vary considerably. If the area is not too densely populated, it may be desirable to show all buildings. If this is done, a check must be made to see that no buildings have been overlooked. A map user will forgive almost any error in a map except the omission of his own house. As the house symbol used on the topographic maps is of standard size, it is frequently impossible to show all the houses in a congested area. Therefore, houses which were omitted must be added as well as those which have been constructed since the map was made. If it is decided not to show all structures, it may be desirable to show the principal landmark buildings.

In lettering street names, usually it is best to place them within the streets rather than alongside. Lettering should be so spaced as to indicate clearly all street names. Additional lettering such as names of churches, schools, and other public buildings can be added if space permits. The title block should carry the name of the person or firm preparing the map, and the scale and date should be clearly indicated. As it is good practice to indicate the source of any data used, a credit note should be included to the effect that the base has been enlarged from a U.S. Geological Survey topographic map.

The completed map, drafted from the enlargement, is shown in Fig. 3. On this, all buildings have been shown, but names of prominent buildings have not been indicated to avoid crowding the map. Although a much larger area would undoubtedly be chosen in actual practice, this illustration shows what can be done by this method.

Aerial photographs may be used

It is the purpose of this article only to describe the making of street maps from the topographic sheets. However, although the making of maps from aerial photographs is a highly specialized and technical profession, it is possible under some circumstances to prepare acceptable street maps from enlarged aerial photos by the direct tracing method described here.

Aerial photographs have been made of the greater part of the United States, and prints enlarged to any reasonable scale can generally be pur-

chased from the federal government or commercial agency holding the negatives. In areas of little relief, the scale errors will be relatively small. Such photographs can be matched together and the identifiable detail traced from them to give a map which will be satisfactory for many purposes. However, such a map cannot be expected to have the accuracy of one prepared by a skilled photogrammetrist where the photographs are adjusted to horizontal control, and tilt and relief displacements are removed. Information regarding the availability of aerial photographs of any particular area is also available from the Map Information Office of the U. S. Geological Survey.

The preparation and publication of a street map presents an opportunity to the surveyor to bring his work to the attention of the public. Such maps might be produced on a fee basis for the town or city planning board or other agency; or for sale to the public; or for free distribution as an advertising medium. Although the compilation of a town plan by this method does not necessarily require a skilled surveyor, the distribution of a good street map of the town or city will inevitably bring favorable attention to the surveyor, and should prove stimulating and profitable to his surveying practice.

Steel Grating Expansion Joint In Concrete Bridge Decks

In reconstruction of an oil loading wharf at Richmond, Calif., the Standard Oil Company of California has built a 4,000-ft. reinforced causeway which has expansion joints at 600-ft. intervals. At each joint a double row of capped piles divides the causeway into completely independent parts separated by the joint. The structure as a whole was described in *ENR* Nov. 28, 1946 vol. p. 710.

The assumed maximum temperature range was taken at 60 deg. (from 40 to 100 deg. F.) and it was thought advisable to have the joints provide a 3-in. movement—that is, from a minimum of 1 in. to a maximum of 4 in. of open space between the abutting edges of the deck system. The opening is calculated for $2\frac{1}{2}$ in. at 70 deg. F.

The causeway is built entirely of reinforced concrete except for the asphaltic concrete wearing surface. Steel angles at the expansion joints were embedded at the edges of the abutting ends of the concrete deck slabs and a panel of steel grating was placed on either side of the opening, terminating along the forward edge in steel fingers as shown in the accompanying drawing.

The rear edge of the open grating terminates in a $\frac{3}{16}$-in. vertical end band welded to steel bars imbedded in the concrete at 12-in. intervals. The heavy angles at the edges of the expansion joint opening, together with the anchor bars welded to them, were supported during pouring by $\frac{5}{16}$-in. bolts through the forms, the bolts being broken off when the forms were removed.

The notable feature of this design is that as temperature variations cause the steel fingers to slide, they have a direct bearing in all positions on *both* sides of the open joint, which reduces stresses.

The details shown are an adaptation made by A. W. Earl, consulting engineer on this project, of an expansion joint devised by the Irving Subway Grating Co.

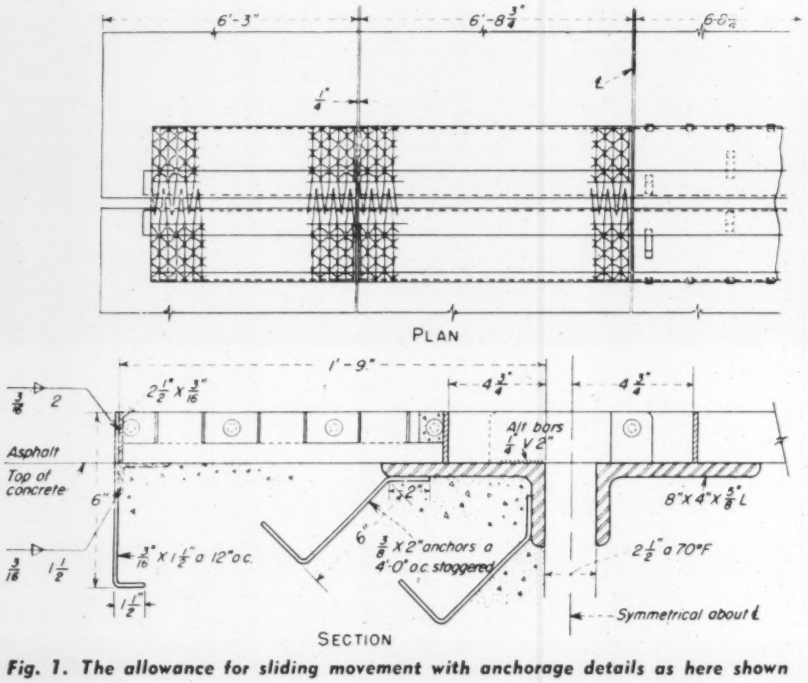


Fig. 1. The allowance for sliding movement with anchorage details as here shown made a very satisfactory expansion joint at 600-ft. intervals in a 4,000-ft. reinforced concrete causeway.

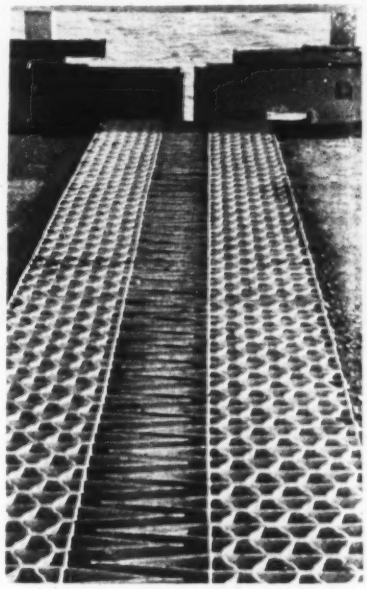


Fig. 2. The steel grating expansion joint in place before the asphaltic roadway surfacing was placed. The sliding fingers provide for a 3-in. wide opening.

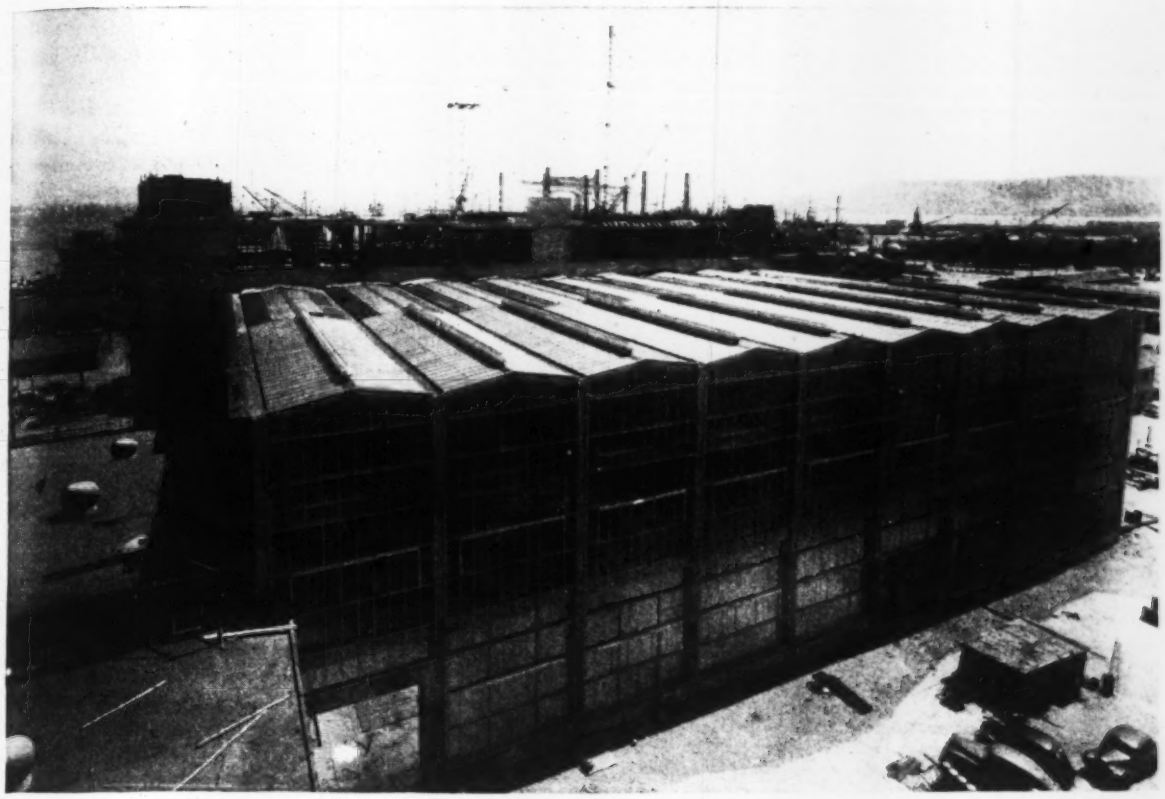


Fig. 1. Glass will make up most of the exterior of this ordnance repair shop building at San Francisco Naval Shipyard.

Navy Building Features Glass Exterior

***Contents in Brief**—Extensive use of glass in walls and roof is a feature of the design of a large shop building under construction at San Francisco Naval Shipyard. The ample supply of natural light thus provided will help in the repair of a gamut of naval ordnance gear running from large components of 16-in. naval gun mounts to delicate optical range finders. Other features of the building are heavy crane runways supported by reinforced concrete columns and crane-girders, a sixth-floor overhanging crane for lifting 15-ton loads from ground level and arrangement of electrical outlets to good advantage.*

GLASS COVERS some 80 percent of the exterior wall and roof surface of a new ordnance repair shop building under construction at the San Francisco Naval Shipyard. Corrugated translucent glass sheets some 2½ x 5 ft. are used for the high-ceilinged, heavylift portion of the building, and clear blue, heat-absorbing glass, in flat panels about 4 ft. square, incloses a six-story section that will house workshops for smaller repair jobs. Both types of glass include wire reinforcing. Other features include design of supports for specialized cranes and the installation of wire raceways completely around the perimeter of each floor so convenient electrical connections can be made.

Different types of glass used

The outstanding feature of the design of this building is the extensive use of glass in the walls and roof with the result that work areas are well lighted and good architectural effect is achieved. The building, 227 x 240 ft., is divided into two parts; the northern part is 151 ft. wide by 67 ft. high for heavy work and the other is 89 ft. wide by 108 ft. or six stories high for lighter work.

The northern portion is in two 75-ft. wide bays, equipped with two 30-ton and two 20-ton capacity traveling cranes respectively. Into these bays will be brought heavy naval ordnance for overhaul and repair.

One bay is unobstructed for its full height, and the other has the equivalent of two stories clear, with what amounts to the third floor fitted with a central locker, toilet and washroom area. Access from the ground floor to the washroom area is provided by means of a reversible-type moving stair that has a vertical travel of 42 ft. 5 in. and a rated capacity of 6,000 persons per hour while traveling at 90 fpm. The stair is so arranged that it will carry workmen

Fig. 2. No artificial light will be required in this shop for the repair of heavy naval ordnance because of the use of corrugated glass in the walls and roof. Spanning this 75-ft. bay will be two 30-ton cranes capable of operating in tandem to make a 60-ton lift.

from ground level up to the locker room area and can then be reversed to return them to the first-floor level.

To provide light without excessive glare, the northern portion was covered with a corrugated translucent glass. The glass comes in sheets 27½ in. wide and up to 8 ft. in length and is set in the steel purlins and girts by means of a specially developed knurled nut. Sheets of the corrugated glass weigh 6¼ psf. and are 7/16 in. thick.

Walls of the six-story portion are covered with a flat, blue, clear glass. As this part of the building has its long dimension on the south side, it is subject to glare from the direct rays of the sun during most of the working hours. Therefore, heat- and glare-resisting glass was used throughout.

This portion of the building will house shops for repair of optical, fire control, gyro and electronic instruments and will, thus, have smaller shop units. As this work is of an exacting nature, ample light is required. Accordingly, columns in this multistory section of the building are set back from the wall. Thus, except for a slab thickness of 15 in. at each floor level, the blue glass extends continuously up the side of the building.

Structural details of interest

In designing a frame work to support the loads imposed by the shop equipment a horizontal force equivalent to 0.03 *g* was used because San Francisco is in an earthquake zone. The exterior wall and roof surfaces contain so much glass that no structural resistance to horizontal forces is available therein. Fortunately, the interior wall between the multistory section and the heavy lift section of the building is solid enough to take most of the horizontal force. A significant portion of this force is taken up by the wall structure around elevator shafts and stairs. Additional reinforcing in the floor slab and the concrete columns is required to take the remainder of the horizontal forces.

The multistory section is of reinforced concrete construction. Instead of using deep beams at the edges of the panels, wide drop panels are used. Column spacing is 25 ft. in one direction and 29 ft. 2 in. in the other, the 25-ft. spacing being along the length of the building. The drop panels, 15 in. thick, run across the building and also along the outside edges of the building's long dimension. The rest of the slab is 10 in. thick, this thickness being required by a design live load of 250 psf. The drop panels were made just 8 ft. wide so that one sheet of plywood could be used in the forms with no cutting required.

Composite piles support the building

The building site is underlain by a 15-ft. thick layer of recently deposited rock fill over another thickness of some 15 ft. of bay mud. To provide uniform loading of the underlying foundation material, composite piles on 5-ft. centers are used to support the building, with each pile assumed to carry some 25 tons. These piles have an 8-ft. concrete section at the top and are wooden below the water level. To get the piles through the rock fill, a 16-in. steel pipe with a 17-in. dia. loose cover was driven through the fill. After withdrawal of this "spud," the 14-in. wood portion of the composite pile was placed in the resulting hole and driven to full penetration in the underlying firm clay. The steel form for the concrete section was spliced to the wooden section and the concrete poured in place.

This method of "spudding" through the upper thickness of rocky fill was devised to prevent driving resistance in a material that will ultimately afford no support to the piles. It will also result in less "down-drag" on the piles as the fill settles.

The piles support a flat-slab footing similar in design to the upper floor slabs, except that it is inverted and is heavier, having a uniform thickness of 32 in. The wood-block first-floor deck is supported by the floor slab and is not dependent on the ground for support, as the fill on which the building is placed is expected to settle faster than the building.

Housed in the heavy lift portion of the building is a 60-ton capacity crane

(two 30-ton cranes operating in tandem through the use of an equalizing beam) at a height of 50 ft. In an adjoining bay is a 40-ton crane (two 20-ton cranes in tandem) at a height of 31 ft. Each set of cranes spans a 75-ft bay. The concrete columns between these two bays, which support the crane rails, are 2 ft. thick by 4 ft. wide. Because the spaces between these columns had to be left clear, the columns are portal braced rather than diagonally braced, as is customary when steel columns and crane-girders are used.

An interesting example of specialized design is exhibited in a 15-ton capacity, periscope crane which extends out from the sixth-floor level. Heavy periscopes and range finders from submarines and large gun batteries are to be hoisted to the sixth floor to be calibrated and repaired. Here they can be set up in a specially designed tower and sighted on distant objects so that the accuracy of the setting of the parts can be determined or checked.

This crane lifts the periscopes from railroad cars close to the building; moves out so that if the periscope swings it will clear the building; hoists the loads to the sixth floor; and takes them into the building. The same crane trolley can move the heavy instruments to any location on the floor to be worked on or set up for calibration. A cantilever frame combining two 36-in., 150-lb., wide-flange beams spaced 25 ft. apart extends 38 ft. out from the building at the roof level to support the runway for this special crane, which results in a lift of some 100 ft.

Special provision for electrical supply

Two features of electrical design permit easy accessibility to power supply. On each floor of the multistory section, except the sixth, two inclosed, plug-in type, bus-bar laterals hanging from the ceiling run the length of the building. One lateral is 34 ft. from the interior wall and the other 30 ft. farther out. These bus-bar laterals carry 480-v. power, and spaced on 2-ft. centers are takeoff devices, each protected with an individual circuit breaker.

Besides the bus-bar system, an under-floor duct raceway is provided for ready means of bringing power to machine tools and work tables. Floor ducts are spaced 10 ft. across the width and 25 ft. along the length of the building. This system connects at frequent intervals into a wire raceway running around the perimeter of each floor. The raceway provides connection with the 125/250-v. d.c. system; the 480-v., three-phase a.c. system; and the 120/208-v., three-phase, four-wire a.c. system.

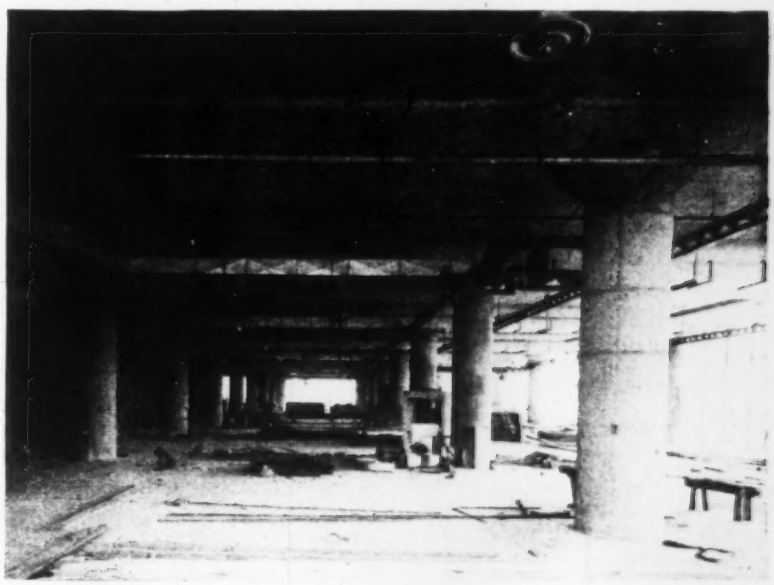


Fig. 3. Simplicity of the concrete design of the multistory section can here be seen. The open exterior walls will be covered with a glare- and heat-resistant glass.

With the use of both the raceway and the bus-bar system, flexibility in use of floor space is assured. When the changing needs of the Navy require new machines, electrical connections can be made with ease and at little further expense. New conduits will not be required and old connections, when abandoned, will not indicate a large economic loss.

To facilitate making future connections involving punching through the floor slabs of the multistory section, 4-in. dia. metal "cans," 8 and 13 in. high, for the 10- and 15-in. floor slab sections respectively, are provided at intervals of 4 ft. in one direction and 5 ft. in the other throughout the supported floor areas. As these cans were tacked to the forms, they may easily be located from below and will thus provide a ready means of making connections to machinery for gas, air, water, waste or electrical service. Such connections may be required at any point in the building.

On the ground floor, a lean concrete fill, 5 in. thick, was placed on top of the foundation slab and beneath the wood-block flooring. When connections are required, the wood blocks can be removed and the services placed below them by chipping out the required amount of lean concrete. Overhead connections are precluded because of the bridge cranes, large and small, in practically all stories of the building.

Navy and civilian men participated

Design and construction of this building is under the jurisdiction of the Bureau of Yards & Docks of the Navy. Rear Adm. J. J. Manning, CEC, USN, chief of the bureau, Capt. W. T. Eckberg, CEC, USN, is public works officer at the San Francisco Naval Shipyard in charge of the construction, and S. S. Gorman is project manager.

The design of the building was by Ernest J. Kump Co., architects and engineers of San Francisco, for whom Ernest J. Kump did the architectural design, Mark Falk the structural design, Edwin W. Sharpe the electrical design, and G. M. Richards the mechanical design.

General contractor is Peter Kiewit Sons Co., Inc. The corrugated glass and its connections were supplied by the H. H. Robertson Co. and the blue plate glass by the W. P. Fuller Co. Raymond Concrete Pile Co. did the pile driving work as a subcontractor under Guy F. Atkinson Co., general contractor for the foundation work.

Wooden Dam With Flash Flood Protection

Contents in Brief—After a log-crib dam with inadequate spillway capacity had to be demolished to protect a lumber mill from destruction by an unprecedented 20,000-sec.-ft. flood, a rock-and-timber-crib dam was built that had provisions for quickly removing some 10 ft. of flashboards should a similar emergency occur. The timber dam was built by logging operations employees from materials available nearby and the mill was thus back in production in a relatively short time.

A ROCK-AND-TIMBER-CRIB DAM built to replace a demolished log-crib dam with insufficient spillway capacity has provisions for quickly lowering the crest height some 10 ft. should an emergency occur. Located in the timber country at West Fir, Ore., on the north fork of the Willamette River, this dam raises the river height some 20 ft., providing ample water for lumber mill operations even in periods of low flow.

Normal dry-weather flow in the stream is 40 sec.-ft., but when an unprecedented 20,000-sec.-ft. flood threatened the mill the original dam had to be demolished. Spillway capacity of the old dam, even when the three Tainter gates were lifted, was inadequate for such a flood. The river topped its right bank and was scouring out a new channel between the dam and the mill when it was necessary to blast the old dam out of the path of the river to save the mill.

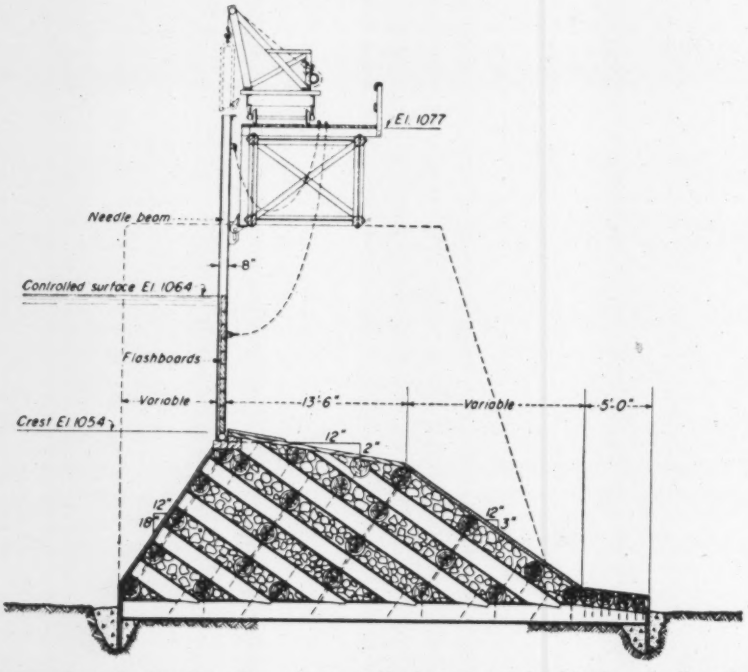
The dynamite work restored the river to its original channel only after the mill started to disintegrate from the effects of the flood. Fortunately, most of the mill remained intact and the major problem facing the owners was the construction of a new dam so the mill could resume operations.

Flashboards released by needle beam

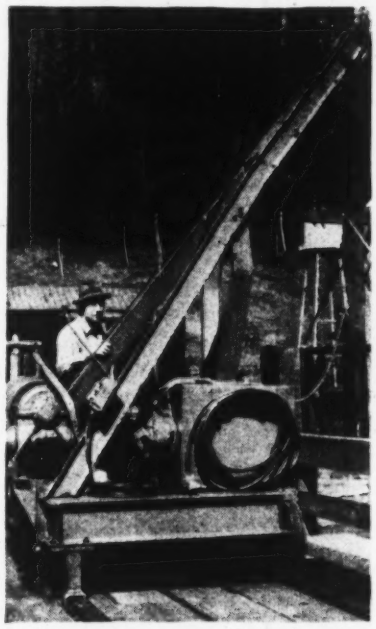
Taking the place of the old dam is a new rock-and-timber-crib dam fitted with needle beams holding flashboards that extend 10 ft. above the crest of the crib. The needle beams are hinged some distance above the top of the flashboards and when pulled out of a slot in the crib they swing on these hinges and release the flashboards. The flashboards flow on down stream and are lost—a cheap price to pay for saving the mill.

The fifteen needle beams are set 8 ft. apart except for four midstream piers. These beams are made of 8x8-in. by 40-lb. I-beams with a roller attached on the bottom. Guides of curved angle beams are set on the top of the crib to guide the roller into the slot when replacing the needle beams. In this manner, the beams can be returned to a true vertical position and no underwater work is required.

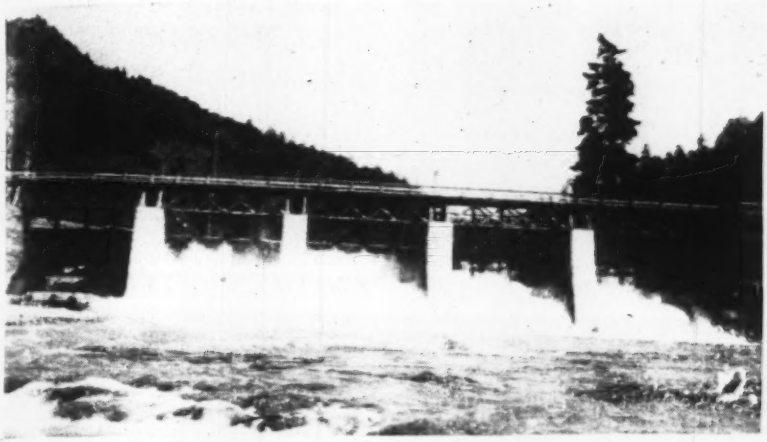
Six-inch thick flashboards are placed against the web of the beams and are held in place by the flanges. Needle beams are not used at the abutments and the midstream piers. Instead steel channel sections are per-



Section through the dam shows how needle beams can be lifted and allowed to swing free, thus loosening the flashboards. This is done with a traveling winch, shown at the right, which also sets the flashboards.



This rig can pull up the needle beams to free the flashboards in a relatively short time during floods that might threaten the mill.



This rock-and-timber crib replaced a former dam damaged because of a flash flood. Crest height can be quickly lowered 10 ft. in an emergency.

An unprecedent flood washed around the right abutment of a log dam seen in the foreground and the mill in the background was threatened when the dam was blasted to divert the flow of the river.

manently fixed at these points to hold one end of the boards set in the adjacent bay.

A winch mounted on a car traveling on rails on a specially built platform on top of the dam is provided to remove or replace individual flashboards for daily regulation of flow. In case of flash floods, this apparatus can lift individual needle beams from their seats, releasing entire bays of flashboards at once. A pull of some 3,000 lb. is required to unseat the needle beam, a pull of some 500 lb. to lift the beam into a horizontal position, and a pull of some 4,000 lb. is required to replace the beam against the flow of water when the flashboards are to be replaced.

The main portion of the dam consists of a rock-and-timber-crib that has a board facing. The streambed was excavated to rock foundation and a concrete seal cast in a cutoff trench at the upstream and downstream edges of the crib. Large base logs placed parallel to the center line of the river rest on the bottom and butt against each concrete cutoff. These logs are spaced 8 ft. on centers and are notched to receive diagonal logs. Other logs are placed across the river between the diagonal logs and the balance of the crib is filled with carefully placed rocks averaging 75 lb. each. The logs are securely bolted together by use of $\frac{3}{4}$-in. drift bolts. Topping this structure off on the upstream face, a tight facing consisting of two layers of 2x12 planks, so placed that the joints are staggered, is spiked to the logs.

The crest of the dam is 187 ft. 6 in. between abutments and there are four intermediate piers spaced 37 ft. 6 in. on center. These piers are 6 ft. thick and serve to support the operating deck. Pier and abutment construction is also of rock-and-timber-crib design.

Although this dam is relatively small as dams go these days, it is complete in every detail—even to having a fish ladder conforming in all respects to the requirements of the state game commission. The ladder is also of timber construction and consists of a series of pools 6 ft. long, each pool being 12 in. lower than the one immediately above.

Construction by company forces

Because the lumber mill was shut down for lack of the dam, mill hands and lumber jacks pitched in to construct the new dam. The timber work and other heavy work required was of a type with which these men are familiar. Consequently, the dam went up in a relatively short time. Materials for construction of the new dam were easily obtainable from the nearby woods and from mill stock on hand. During construction, the river was diverted through the mill pond and the unnatural channel conveniently dug between the dam and the mill during the flood.

This dam was built for the Edward Hines Lumber Co. at West Fir, Ore. Engineering was done by John W. Cunningham & Associates, Portland, Ore., who were represented by F. S. Zeidlhack on the design.

Coated Aluminum Tape Used for Waterproofing

Moscow's subway builders have developed a new type of water-proofing material identified as "Metalloizol" (metal insulation) for use in insulating the subway's concrete tunnel against leakage of ground waters.

"Metalloizol" consists of a thin aluminum tape, 0.25 mm. thick, covered on both sides with a film of bituminous material which is applied at a temperature of 300 to 350 deg. F. In one 3-mi. tunnel section now under construction, 10,000,000 sq.ft. of the new material is being used.

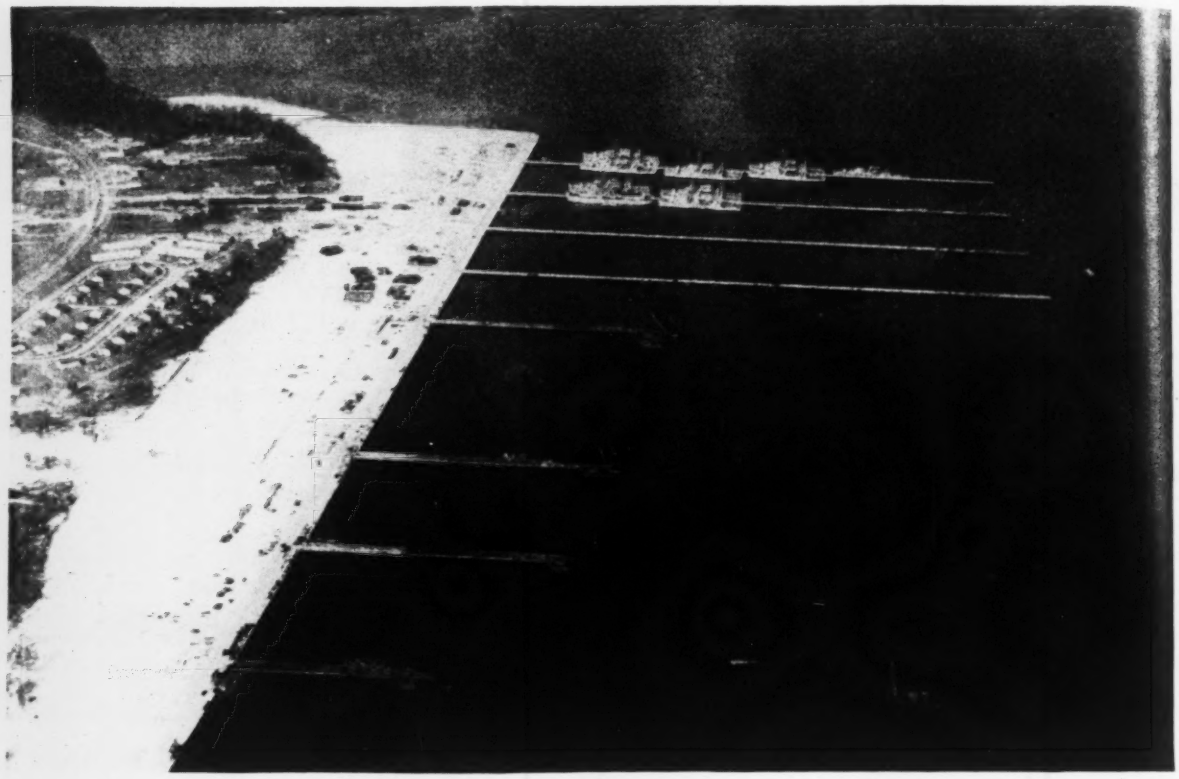


Fig. 1. To tie up 554 surplus ships at Green Cove Springs, Fla., eleven piers 1,845 ft. long were built.

Long Piers for the Navy's Surplus Ships

***Contents in Brief**—In constructing eleven parallel piers 1,845 ft. long on the St. Johns River the steel foundation piles were driven by floating equipment, one rig first driving the vertical piles and a second the batter piles with the hammer supported in a bridle. Concrete for the deck, which was built in 200-ft. sections, was produced in truck-mounted mixers and pumped to the desired point through an 8-in. dia. line. Construction of the long sheetpile bulkhead parallel to the shore called for the use of a special rail-mounted driver in putting down the timber anchor piles, while the 7,000,000-cu. yd. dredging task was accomplished in nine months with a single dredge.*

A PIER building project that was characterized by speedy construction was completed early last year at Green Cove Springs, Fla., 20 miles up the St. Johns River from Jacksonville. It was carried out by the Bureau of Yards and Docks of the Navy to provide berthing space for over 500 small ships that had been placed on inactive status. Speed was made necessary by the fact that the vessels were lying at anchor in the river where they might be cast adrift by high winds with destructive results.

The Green Cove Springs operation is the largest undertaken by the Navy. It cost $13,000,000. Included are eleven parallel piers 1,845 ft. long and on 500-ft. centers extending out from a continuous steel sheetpile bulkhead 5,405 ft. long. Ten of the piers are 30 ft. wide, designed for ships to be tied up four abreast on each side. The eleventh pier is 50 ft. wide. It is for servicing hulls, with accommodation for two floating drydocks on either side.

As the vessels are of light draft, a water depth of 13 ft. was provided for about half the berthing area and 18 ft. for most of the remainder. A depth of 35 ft. was provided for the drydocks.

Bulkhead construction

Examination of the site indicated that the bulkhead should be located about 500 ft. out from the shore where the water depth was 5 ft. Fill for the enclosed area could be obtained in dredging the berthing area. Along the line selected for the bulkhead a sheetpile depth of about 27 ft. would be required to provide adequate support for a bulkhead with its top 8 ft. above mean water level. Piles of this length could be provided econom-

ically by cutting standard 55-ft. sheetpiles in half. Sheetpiles weighing 27 lb. per sq. ft. were used.

To provide an anchor for the sheetpiling a row of untreated timber piles was driven 24 ft. landward from the bulkhead. These piles, which average 55 ft. in length and 13 inches in butt diameter, are on a batter of 12 on 6 with one half of the piles sloped toward the bulkhead and the others away from the sheetpile. A continuous reinforced concrete cap 2 ft. thick and 4 ft. wide is provided at the top of the batter piles, which were cut off about 6 ft. below the top of the sheetpiling. The cap is connected to the bulkhead by 2-in. dia. steel rods at 10-ft. 8-in. centers, a continuous wale made up of two 10-in. 20-lb. channels being provided where the rods are attached to the sheetpiling.

Land equipment was used in construction of the bulkhead. To permit this, fill material was delivered by hydraulic dredge at a point about 60 ft. inward from the location of the sheetpile until a berm approximately 2 ft. above mean water level was provided. The fill material was primarily sand, and it took a sufficiently flat slope that at the point where the sheetpiling was to be driven the fill was from a few inches to about 1 ft. above water level, which was enough for the land equipment.

Fig. 2. Timber batters piles to provide anchorage for the sheetpile bulkhead were driven with this special rail-mounted driver.

Special rig speeds driving

To drive the anchor piles the contractor built the special rail-mounted rig shown in Fig. 2. A 10,000-lb. single-acting steam hammer with a 5,000-lb. ram was mounted in the fixed leads sloped to the batter of the piles.

The general procedure was to drive the piles sloped toward the bulkhead for as great a distance as possible or as far as the berm had been completed, which sometimes was as much as 1,000 ft. Next the rails for the driver, which were of 25-ft. gage, were shifted over and the driver turned around to drive the piles of the opposite batter. With this method as many as 85 piles were put down in an 8-hr. day; the average daily progress was about 65 piles.

Driving of the sheetpile for the bulkhead was carried out closely behind construction of the batter-pile anchorage. In this work a single-acting hammer with a 1,200-lb. ram handled by a crawler crane was employed. Steam for the hammer was supplied by a 50-hp. boiler mounted on a narrow-gage track with one rail common to the track of the special pile driving rig. Many days the piling for as much as 100 lin. ft. of the bulkhead was driven, the daily progress averaging 75 ft. The bulkhead was capped with a reinforced concrete cap 2 ft. wide and 1 ft. thick.

The fill material was added as closely behind construction of the bulkhead as possible. To expedite the placing of the large amount of material needed behind the low berm previously mentioned, a dragline and a bulldozer working on this berm frequently built it up into a dike about 15 to 16 ft. high. Fill material could then be added behind the dike while work on the bulkhead went ahead. Once a section of the bulkhead was completed, bulldozers moved any surplus fill over against the bulkhead. Later, after the numerous utility lines to piers were in place, a 40-ft. wide paved road was constructed adjacent to the bulkhead.

All the excavation and fill work was accomplished with a single hydraulic dredge equipped with a 30-in. suction line and a 27-in. discharge line. Power for the pump was supplied by a 2,150-hp. diesel engine and that for the cutter and auxiliaries by an 800-hp. diesel unit. A 300-hp. engine was also available for the auxiliaries when the pump was not working.

Discharge from the dredge contained from 10 to 15 percent solids and dredging continued three 8-hr. shifts daily seven days a week. The 7,000,000-cu. yd. excavation job was completed in nine calendar months

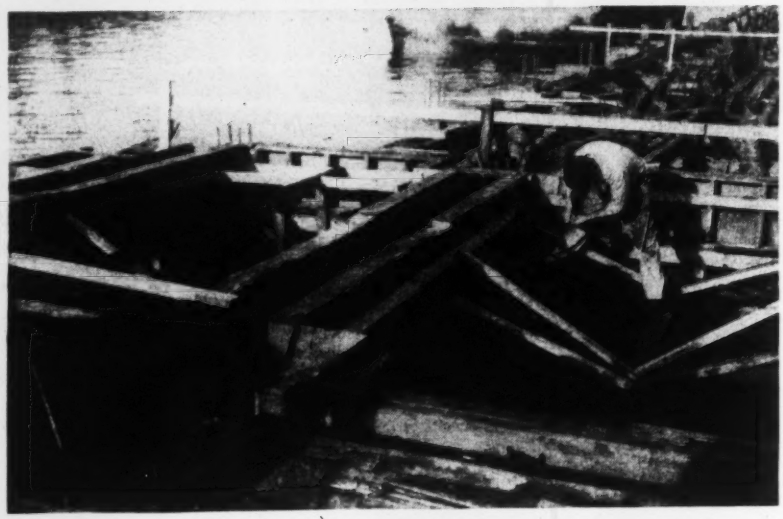


Fig. 3. Deck forms for the piers were supported on double 12x16-in. transverse timbers attached to the piles of each bent and 6 x 12-in. longitudinal stringers (top). The forms consisted of ½-in. plywood nailed to 3 x 6-in. studs (center). Transverse and longitudinal beams were made the same depth and four 1-in. square rods were welded to the top of each steel pile (bottom).

with an average crew of 80 to 85 men. This progress was made despite the fact that a 10,300-ft. discharge line had to be used some of the time.

Piers designed for economy

In designing the piers, extensive study was made to assure maximum economy in the use of materials, in view of the great length and number of the piers. Three different bent spacings were considered in detail and as many different arrangements of the piles. Final choice for the 30-ft. wide piers was for four-pile bents on a 20-ft. spacing with each bent made up of two vertical piles and two batter piles forming an A-frame at the center of the bent.

This arrangement, which called for the batter piles to be driven to a slope of 12 on 4, offers high resistance to horizontal loads and the batter piles carry a good proportion of the vertical load. For Pier 6, which is 50 ft. wide, the typical bent is made up of 9 piles consisting of five vertical and four batters driven as two A-frames.

Various types of piles were considered but the final choice was for the use of 12-in. 53-lb. steel H piles for the narrow piers and 14-in. 73-lb. H sections for Pier 6.

The reinforced-concrete slab-and-girder deck of all piers was designed for a live load of 300 lb. per sq. ft. or an H-15 highway loading, whichever governed. On the 30-ft. piers the deck is 8 in. thick at the edges and 9 in. at the crown and three lines of beams 16 in. wide extending 22 in. below the deck are used. The depth of the bent beams or those in the plane of the bents was made the same as that of the longitudinal beams. Also, this beam was lightly reinforced to cause most of the load from the longitudinal beams to go directly into the supporting piles, which are equipped at the top with seat angles. To assure adequate resistance to uplift, four 1-in. square bars are welded to the top of each pile.

Layout of the deck for the 50-ft. wide pier is much the same, except seven lines of longitudinal beams are provided. The overhang of the deck at either side with both widths of piers is 5 ft.

Before driving of the 9,990 steel piles required was begun, extensive load tests with several pile types and

sizes were made. This work revealed that driving of the piles to a stratum of hard sand would produce adequate bearing, although by conventional pile formulas a large bearing would not be indicated. Therefore, the piles were driven to certain specified depths, rather than to depths determined by formula. This plan, which resulted in the piles having a length of 80 to 85 ft., permitted shorter piles to be used and resulted in an appreciable cost saving.

To assure adequate protection of the portion of the piles exposed above the water, this length of the piles was flame cleaned and all scale removed with steel brushes, followed by two coats of bituminous enamel. The prime coat was applied at a temperature of about 80 deg. F. while the steel was still hot and the finish coat at 375 deg. F. For that portion of the piles to be continuously below the water level no protection was considered necessary, since sufficient oxygen for severe rusting is not available in the water.

Driving of the piles was accomplished with six steam-powered 30-ton floating rigs. General practice was to drive the vertical piles with one rig equipped with fixed leads about 95 ft. long, while a second rig drove the batter piles. In this latter work, the hammer was supported in a bridle, rather than swinging leads.

All the forms for the deck were supported on the permanent steel piles. In this work two 12x16-in. transverse timbers were used at each bent. The longitudinal stringers were 6x12-in. timbers and the forms proper consisted of ½-in. thick plywood nailed to 2x6-in. studs, which resulted in sturdy panels permitting reuse several times. Assembly of the forms was expedited by the use of rafts made up of steel cells of the type used so extensively by the Navy during the war.

Concreting in 200-ft. sections

To permit specialized crews to be shifted from pier to pier when constructing the deck, operations were usually in progress on four piers at a time. General practice was to place concrete for 200 ft. of pier as one continuous operation, this work taking about six hours.

A concrete designed for a compres-

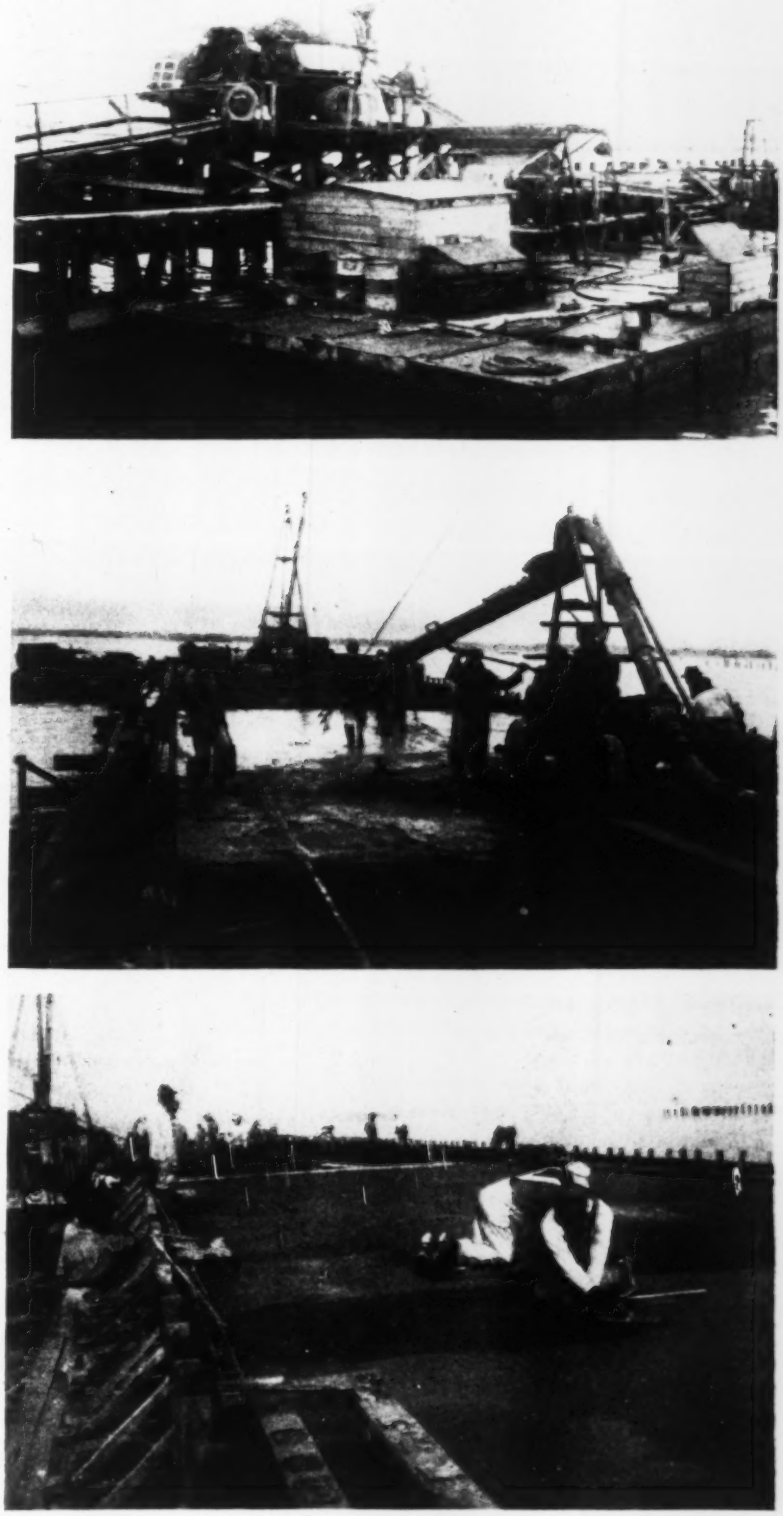


Fig. 4. Concrete for the piers was mixed in truck-mounted mixers and transported to the desired point along the pier by an electrically driven pump mounted on a raft assembled of steel cells (top photo). The discharge end of the 8-in. dia. delivery pipe was supported on a rubber-tired rig moved along on temporary planks as work advanced (center). Finishing was the steel hand trowels (bottom).

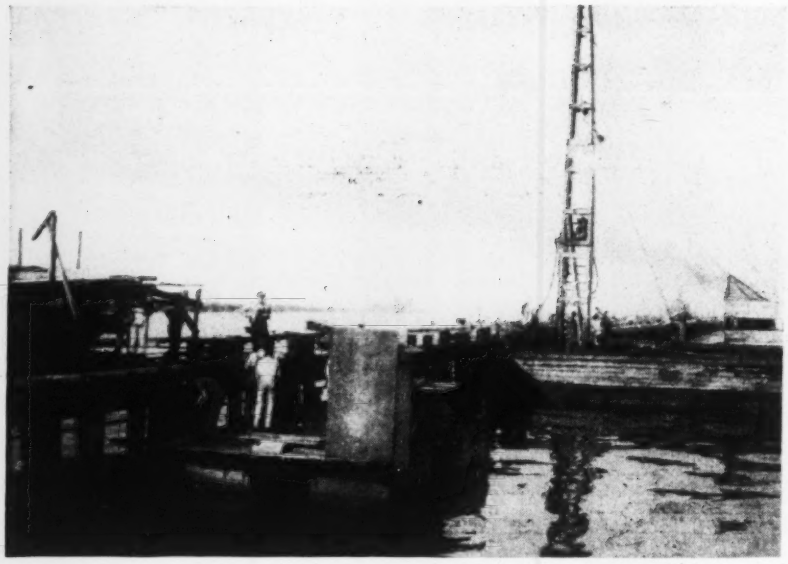


Fig. 5. As a last operation in completing a pier, creosoted fender piles on a 4-ft. spacing were added at either side, the piles being driven with a floating rig with fixed leads (left). The piles were secured to the pier by bolts equipped with anchor sleeves before being embedded in the concrete deck (right).

sive strength of 3,000 psi. was used. Normally the mix consisted for 94 lb. of ordinary portland cement, 150 lb. of fine aggregate, 316 lb. of crushed stone coarse aggregate and not more than 55 gal. of water. The concrete was batched at a central plant and delivered to the desired pier in truck-mounted mixers.

Concrete pumped along piers

An electrically driven pump mounted on a large steel-cell raft and discharging into an 8-in. dia. line was used to deliver the concrete to the desired point along the pier. This arrangement permitted the delivery trucks to back up a temporary ramp for discharge by chute into the hopper of the pump (Fig. 3). In constructing a 200-ft. section, the discharge pipe was extended to the far end of the section and the discharge spout supported on a rubber-tired four-wheel truck at sufficient elevation to permit the concrete to be delivered by means of a swinging chute to any point across the deck. As placing of the concrete advanced, the delivery pipe was shortened in 20-ft. sections. This work required the pump to be shut off for less than a minute.

Once the first 600 ft. of a pier was completed, the raft on which the pump was mounted was moved to the end of the completed section. Then, as soon as the delivery trucks could use this part of the pier, placing continued from this point.

The concrete was vibrated in place with pneumatic portable vibrators, the necessary air for the vibrators and numerous other pneumatic tools used being supplied by compressors on land discharging into large surge tanks. Curing was with a membrane compound.

All the permanent utility lines extending along the piers, including the water lines to the numerous fire hydrants, the electrical power conduits, and the several other lines, were suspended from the deck. Installation of this piping followed closely behind the stripping of the forms, as did construction of the 8-in. high curbs at either edge of all piers.

Timber fender piles

Installation of the fender piles at either side was the last operation in constructing a given pier. In this operation, creosoted timber piles of 12 to 14-in. butt diameter and 55-ft. average length were added on a 4-ft. spacing. The piles were driven with a floating rig and they were attached to the pier by means of bolts equipped with sleeves of the type shown in Fig. 5. An 8x8-in. horizontal creosoted timber was used between piles, of which over 10,000 were required.

Excellent progress was obtained in constructing piers by these methods. The first piles were driven July 9, 1946, and by Nov. 14, of that year four piers were in use, four more by the middle of February, 1947, and all eleven piers by March 15. The crew working on the piers averaged about 600 men and a 40-hr. week was worked, considerable overtime being required.

Who did the work

The contract for the dredging and construction of the bulkhead was held by Standard Dredging Corp., New York, with T. P. Pearson, general superintendent. This firm sublet the bulkhead to the George D. Auchter Co., Jacksonville, Fla., for which George D. Auchter, Jr., was project manager. Merritt, Chapman and Scott, New York, constructed the piers. C. A. Richardson served as project manager for that organization on pier work.

All the facilities were designed by the Bureau of Yards and Docks under the general direction of Rear Adm. W. H. Smith, director of the Planning and Design Department. For the Atlantic division of the bureau Rear Adm. L. B. Combs was director. On the project Capt. C. G. Smallwood was resident officer in charge of construction. B. A. McConnell was his chief assistant on the field work, and Lewis A. Holborn was in charge of the engineering department.

"Step" Aeration of Activated Sludge Handles High BOD Loadings

Experience with the "step" method of activated-sludge treatment shows that biochemical oxygen demand can be reduced 90 percent in the secondary system when the loading is two to three times greater than that normally handled by the conventional activated-sludge process. This was one of the results obtained last year at New York's Bowery Bay plant during a seven-month trial of step-aeration treatment with an average sewage flow of 40 mgd.

"Step" aeration is defined as "the introduction of sewage in controlled amounts at multiple points along the flow of returned activated solids through the aeration tank." Differing from the conventional activated-sludge process, this new operating technique provides for longer-than-normal detention of returned solids and makes possible the storage of more solids under aeration for a given aerator-effluent concentration.

A description of the process and a summary of plant performance were reported at a recent meeting of the New York State Sewage Works Association by Wilbur N. Torpey, civil engineer, Department of Public Works, New York, N. Y.

Mr. Torpey pointed out that the Bowery Bay plant includes provisions to use step modification of the activated-sludge process. The aerator is equipped with piping and valves so that primary effluent can be delivered to the 1st, 2nd, 3rd, or 4th passes in various combinations. Based on a sewage flow of 40 mgd. and 25 percent return sludge, the theoretical detention periods are: primary sedimentation, 1.0 hr.; aeration (conventional basis), 2.5 hr.; and final settling, 1.7 hr.

Operation governed by three controls

Three control criteria were used during step-aeration operation. The first and most important control was sludge "age". Sludge "age" is defined "as the average number of days suspended solids remain under air from the time they first enter the secondary system until they leave." Mathematically, it is computed by dividing the weight of suspended solids under aeration by the daily weight of suspended solids imposed on the secondary system. The quotient is expressed in days. During this study, it was attempted to maintain a sludge "age" of 3.5 days.

The 30 min., cylinder-settling test was used for the second control, the standard one-liter graduate being used for this purpose. The aim was to maintain settling values of aerator effluent at 20 percent or less and particularly to avoid wide fluctuation of this measurement throughout the day and night.

Alteration of the method of adding primary effluent to the aerator provided the third control. When secondary-system loading was relatively low, primary effluent was introduced in equal amounts to the beginning of the 2nd and 3rd passes. When the loading increased and the secondary system was losing stability, primary-effluent injection was shifted to the 3rd and 4th passes of the aerator. Before this change, only the 1st pass carried return sludge; following it both the 1st and 2nd channels held return sludge.

Primary-effluent feedings shifted

After stable operation had been regained, additions were reverted to the 2nd and 3rd passes in anticipation of future shock loads. During the seven-month trial, five such changes in the mode of primary-effluent feeding were made so that six periods of operation were established. By such adjustments in feeding primary effluent to the aerator, highly flexible treatment in adjusting to loads was made possible.

When primary effluent was fed to the 2nd and 3rd passes of the aerator, the average concentration of suspended solids in the aerator and in the overflow was 3,100 and 1,750 ppm., respectively. During 3rd- and 4th-pass additions, the corresponding values were 3,900 and 1,610. The return-sludge rate varied from 28 to 34 percent of the sewage flow and the sludge index (Donaldson) ranged from 0.7 to 1.2 on a 75 percent volatile sludge during the six periods. [The sludge index (Mohlman) is found by dividing volume of settled sludge by suspended solids, both in percent; the Donaldson index is quotient of 100 divided by the Mohlman value.]

During the seven-month study, the aerator handled 54 to 84 lb. of BOD per 1,000 cu. ft. of aerator per day and the secondary system removed 85 to 94 percent of that load, Mr. Torpey said. This performance compares favorably with conventional aerators that carry 25 to 30 lb. of BOD per 1,000 cu. ft. of aerator per day.

Air requirements were low

Varying from 0.62 to 0.68 cu. ft. per gallon of primary effluent, the air ratio remained nearly constant throughout the trial. Calculations reveal that an average of 690 cu. ft. of air was consumed in removing a pound of BOD when primary effluent was added to the 2nd and 3rd passes of the aerator. The corresponding average for 3rd-and 4th-pass feedings was 590. However, during the sixth period (41 days) air consumption dropped to 490 cu.ft. per pound BOD removed.

Of particular interest was the fact that, with 3rd and 4th-pass additions, the contact times in these channels were 95 and 35 min., respectively. In this case, the detention time of activated solids was 6.8 hr. If the aerator had been operated conventionally, the detention period would have been 2.5 hr. long.

For the first three periods, the overflow rate from the final tanks averaged 1,030 gal. per sq. ft. per day. Corresponding rates for periods four, five and six were 1,230, 1,190 and 1,130, respectively.

The study showed, Mr. Torpey says, that the least possible quantity of activated solids should be passed to the final tanks, regardless of their settling qualities, while maintaining adequate sludge "age". This criterion was satisfied with the step method of aerator operation in the activated sludge process.

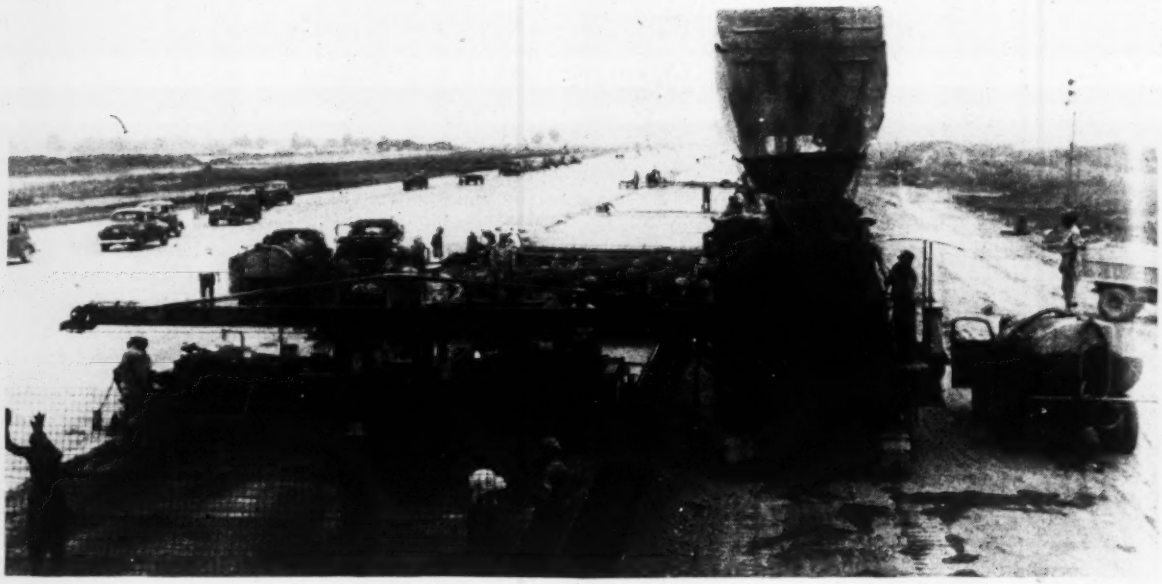


Fig. 1. One of the five 34-E pavers placing concrete in 25-ft. lanes at Patterson Field. Welded mesh was set by hand.

Runways for Seventy-Five-Ton Wheel Loads

***Contents in Brief**—Five 34-E dual-drum pavers—two operating beside the runway and three set up as a central mixing plant—paved one-half mile of 21-in. thick lanes of concrete runway, 25 ft. wide, per day at Patterson Field. Based on full-scale pavement studies at the Lockbourne Army Air Base, the 21-in. runway and 25-in. thick taxiways are designed for a gross plane load of 300,000 lb. on two tires.*

To THE CASUAL OBSERVER, paving the 10,000-ft. long VVHB (very, very heavy bomber) concrete runway at Patterson Field near Osborn, Ohio, was a mechanized operation simplified to such a degree that the individual operations seemed effortless and endless. But behind this smooth-working combination of some 300 men and over 100 major units of power equipment lies a story of organization, adaptation and integration of equipment, material handling, and continuous production of concrete rarely, if ever, encountered on a paving job.

From the contractor's standpoint, volume production of concrete was the paramount objective. That this goal was attained in large measure is apparent from the fact that nearly one-half mile of 25-ft. wide, 21-in. thick pavement was placed in a 16-hr. working day—or 1 cu. yd. of concrete placed in the forms every 15 sec. Best 16-hr. day's pour was 3,192 ft. of 21-in. thick, 25-ft. wide pavement.

Briefly, the new installation includes one 10,000 x 300-ft. runway, a 7,075 x 150-ft. paralleling taxiway terminating at an existing runway at one end and joining a 1,650-ft. warm-up area at the other end which, in turn, connects to the runway. (Fig. 3.) Midway of the runway is a 1,100 x 150 ft. taxiway connecting it with the main taxiway.

Two depths of pavement needed

Taxiways and the warmup area are 25 in. thick, while the runway is 21 in.—all Portland-cement concrete, placed full depth in two continuous operations, and in 25-ft. wide lanes. Adjacent lanes are keyed together with 2½-in. dia. steel dowels, 24-in. long and spaced 18-in. apart.

All pavement is reinforced with nominal temperature steel—No. 5 welded wire fabric spaced 3-in. each way and placed 4-in. below the top of pavement. Transverse contraction joints, 5 in. deep and ½ in. thick, are spaced 28 ft. apart. They are filled with 3-in. strips of premolded bituminous filler and sealed with a rubberized, non-extruding sealing compound.

Designs for the VVHB runway, warmup area and taxiways of Patterson Field were developed from the Corps of Engineers' full-scale pavement studies at the Lockbourne Army Air Base near Columbus, Ohio. These studies consisted of traffic testing of pavement designs bracketing the requirements for wheel loads ranging from 20,000 to 150,000 lb. The theory used for adjusting and extrapolating the tests results was the Westergaard analysis for both interior and edge loading of concrete slabs supported by an elastic subgrade.

All pavement is designed to carry a gross plane load of 300,000 lb.,

Fig. 2. High-speed electric vibrators mounted on the rear of the spreader vibrated the lower 17 in. of pavement concrete.

with a maximum single wheel loading of 150,000 lb. The pressure in the tire for such a load is about 107 psi. No allowance is made for landing impact as the vertical load factor for heavy planes is always measured to be less than 0.8. The wings provide some lift at the speed necessary for normal landings. This practice is borne out by observed performance.

The Corps of Engineers' laboratory at Cincinnati, Ohio, has made various theoretical and model analyses of the effect of dowels, but no precise figure for the unit shearing stresses was used in the design which was based largely on the Lockbourne tests and correlating laboratory studies. It is the consensus of the designers that the shearing stress does not control; but rather the rigidity of the joint assembly or its resistance to vertical deformation.

Final decision was to use the 21-in. and 25-in. depth slabs reinforced only with nominal temperature reinforcement. The use of heavy reinforcement in thinner slabs has proved, by full scale tests, to be less economical than using a heavier plain concrete slab. Also, added difficulties with the jointing would result from the use of thin heavily-reinforced slabs.

Taxiways and the warmup area were designed for a 25 percent overload for the following reasons: Im-

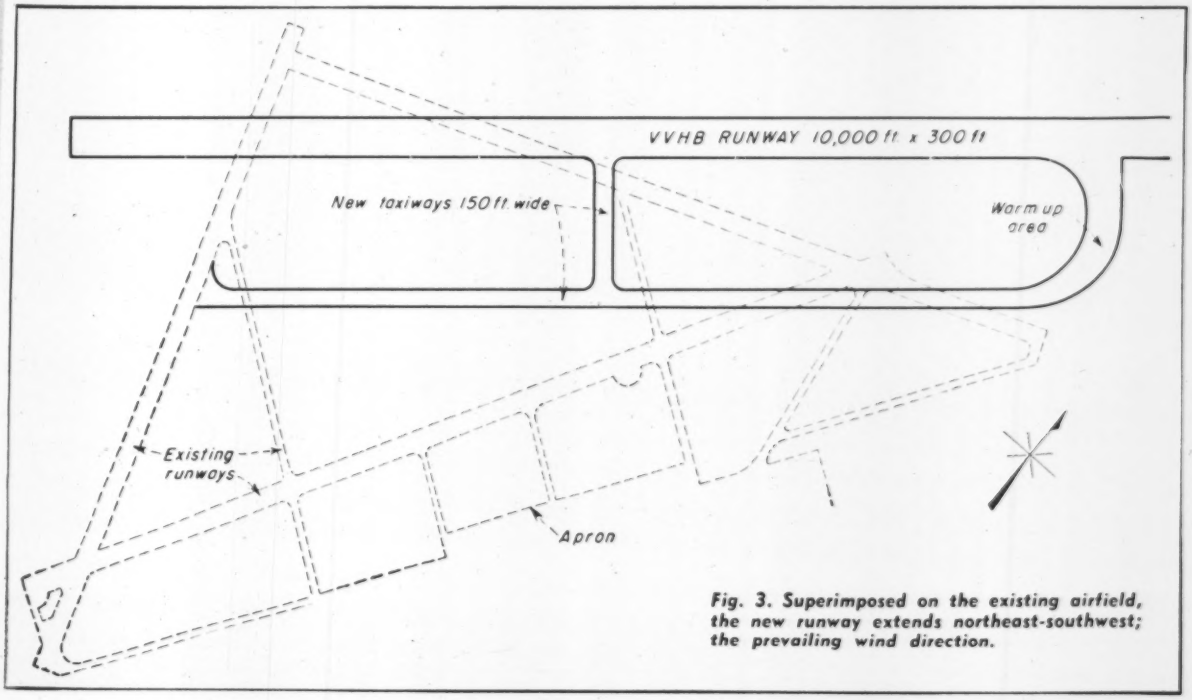


Fig. 3. Superimposed on the existing airfield, the new runway extends northeast-southwest; the prevailing wind direction.

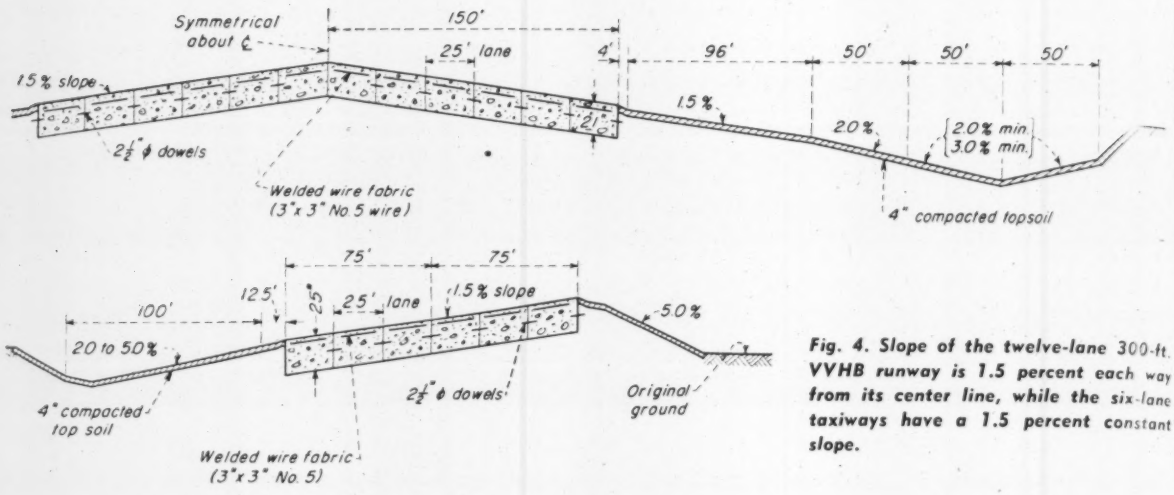


Fig. 4. Slope of the twelve-lane 300-ft. VVHB runway is 1.5 percent each way from its center line, while the six-lane taxiways have a 1.5 percent constant slope.

pact stresses induced by normal operational landings are not critical and can be disregarded. In explanation of this fact the traffic on runways is widely dispersed, the total aircraft load during much of the landing and take-off is largely airborne, and a wheel load quickly passes a given point so that the support of the pavement by the subgrade is not rapidly depleted.

More stress in taxiways

Moreover, stresses in the concrete caused by the slowly moving vibratory loads on taxiways are shown by performance to be more severe than the quick loads on runways. This is explainable by channelization of traffic, time sufficient for depletion of subgrade support and progression of failure. The choice of 25 percent was arbitrary but many observations on existing air fields have not indicated any need for change.

109 acres of pavement

A quick appraisal of the amount of work involved in placing the pavement, which was started last June 19 and was completed by the end of the year, may be gained from the prodigious volume of quantities involved. For instance, there will be 70 acres of concrete pavement 21-in. thick and 39 acres of 25-in. pavement.

To produce this volume of concrete required 1,200 carloads of cement and over one-half million tons of aggregate. To reinforce the pavement required 10,000 rolls of welded wire fabric, while the 141,000 dowels needed to transfer shear between adjacent pavement lanes had a total weight of about 4½ million pounds.

Other major quantities include 975,000 cu. yd. of grading preparatory to paving; 32.5 mi. of electrical cable and 27.5 mi. of duct; 31,500 ft. of concrete drainage pipe ranging in size from 12 to 84-in. dia; and 90,000 sq.yd. of existing concrete pavement to be removed to permit fitting the new runway and taxiways into the existing landing facilities.

Five 34-E dual-drum pavers

As in most paving jobs, the tempo of the work was set by the production rate of the pavers. But in this case drastic departure from customary procedure was made in view of the high rate of concrete production needed. Five 34-E dual-drum pavers were used. Two worked in tandem beside the 25-ft. lane of concrete be-

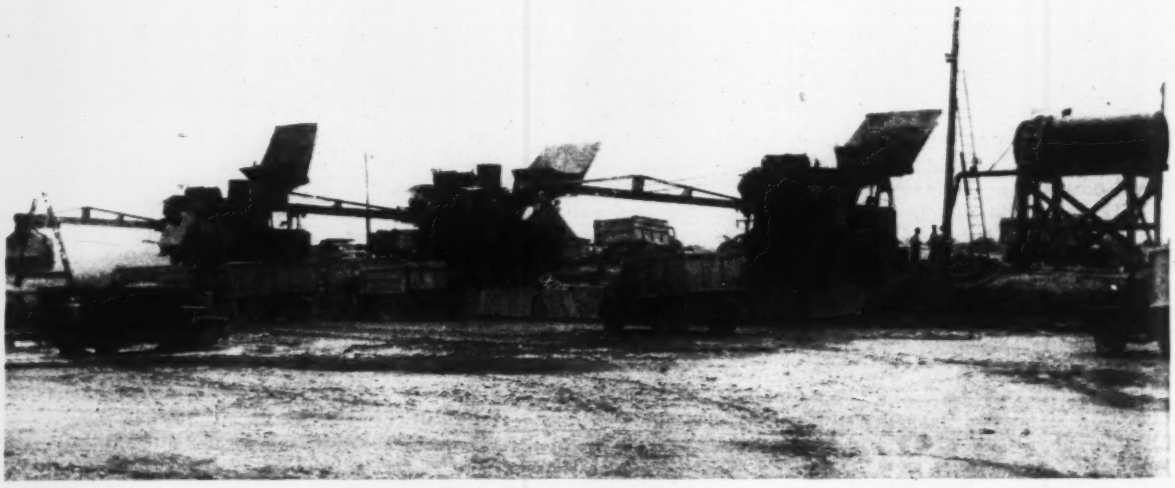


Fig. 5. Located midway between the batching plant and the runway, three 34-E dual-drum pavers operated in parallel as a central mixing plant to feed end-dump, non-agitating trucks, hauling the concrete to the runway.

ing placed, and three pavers were operated as a central mixing plant located opposite the mid-point of the runway and one quarter mile from it.

Concrete was trucked from the mixing plant in end-dump, non-agitating trucks, each carrying 2.8 cu. yd., and dumped into the forms just ahead of the front paver. Maximum haulage time from central plant to forms was 10 min. Working immediately behind the front paver was a concrete spreader which struck off the concrete to within 4 in. of the top of the pavement.

All concrete vibrated

Mounted on the rear of the spreader was a battery of six electric internal vibrators spaced 4½ ft. apart and extending to within 4 in. of the bottom of the pavement. They were powered by two 10-kw. generators, and delivered 9,500 pulsations per minute to thoroughly vibrate the 17 in. of fresh concrete for the runway and 21 in. of concrete for the taxiways and warmup area.

The second paver followed close behind the front one, leaving only enough room for the spreader, and a five-man crew that placed the welded-wire fabric reinforcement 4-in. below the top of pavement.

The top 4-in. of concrete for all pavement was placed by the second paver, following which were two concrete finishing machines, each equipped with external pipe vibrators; a vibrating joint machine that installed the contraction joints; a longitudinal screed; jointing and finishing crews; and a hand-propelled rig for applying a membraneous curing compound to the finished concrete. Final finish of the pavement was by burlap drag and long-handled wooden floats. All concrete was cured a minimum of five days before any extraneous loads were permitted on it.

Subgrade preparation

Although the concrete placing and finishing operations were the most fascinating to watch, those needed to prepare the rough-graded subgrade to receive the concrete pavement were of equal importance—and required considerable foresight in their organization.

In general, the subgrade was prepared by removing 1 to 5 ft. of unsatisfactory material and replacing it with selected material in 9-in. lifts, compacted with sheepsfoot rollers.

Originally, the specifications required all subgrade under the pavement to be compacted to at least 95 percent of the maximum density at optimum moisture content as determined by the Modified AASHO method. This subsequently was reduced to 90 percent density (when ambient temperature was not less than 50 deg. F.) due to the unusual wet weather encountered, and in the interest of expediting the job.

First operation in preparing the subgrade for each pavement lane was smooth-grading with two motor patrols, an earthmoving scraper when necessary, and two three-wheel rollers. A form-grader then cut a smooth, level trench to receive the 21 x 25-in. steel pavement forms, which were positioned and anchored with pneumatically-driven 12-in. pins.

Sections of forms, 12-ft. long and designed for both a 21-in. and 25-in. depth pavement, weighed 850 lb. each. They were handled with front-end-lift, rubber-tired tractors. Final finish of the subgrade was by light grading with a motor patrol grader, followed by a subgrade planer pulled

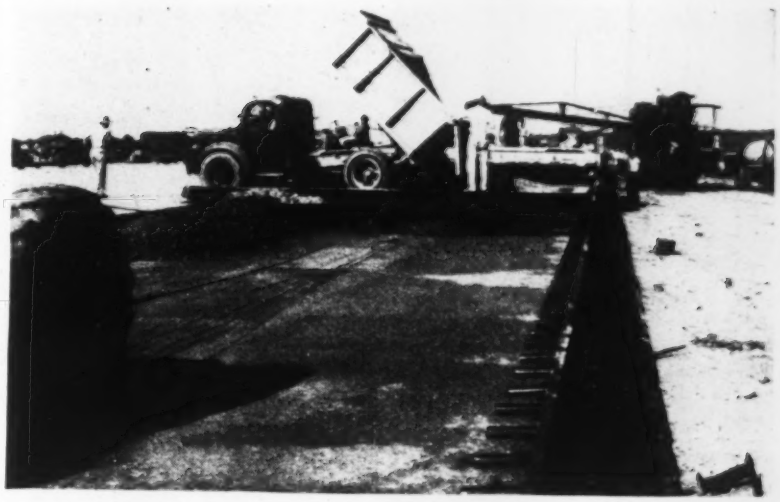


Fig. 6. Concrete from the central mixing plant was dumped in place from a rolling steel-frame bridge riding on the forms. Note 2½-in. dia. shear-transfer dowels held in position by the 21 x 25-in. pavement forms.

Fig. 7. Weighing 70 lb. per lin. ft., the 12-ft. sections of 21 x 25-in. paving forms could be used for both the 21-in. thick runway and the 25-in. taxiway pavements.

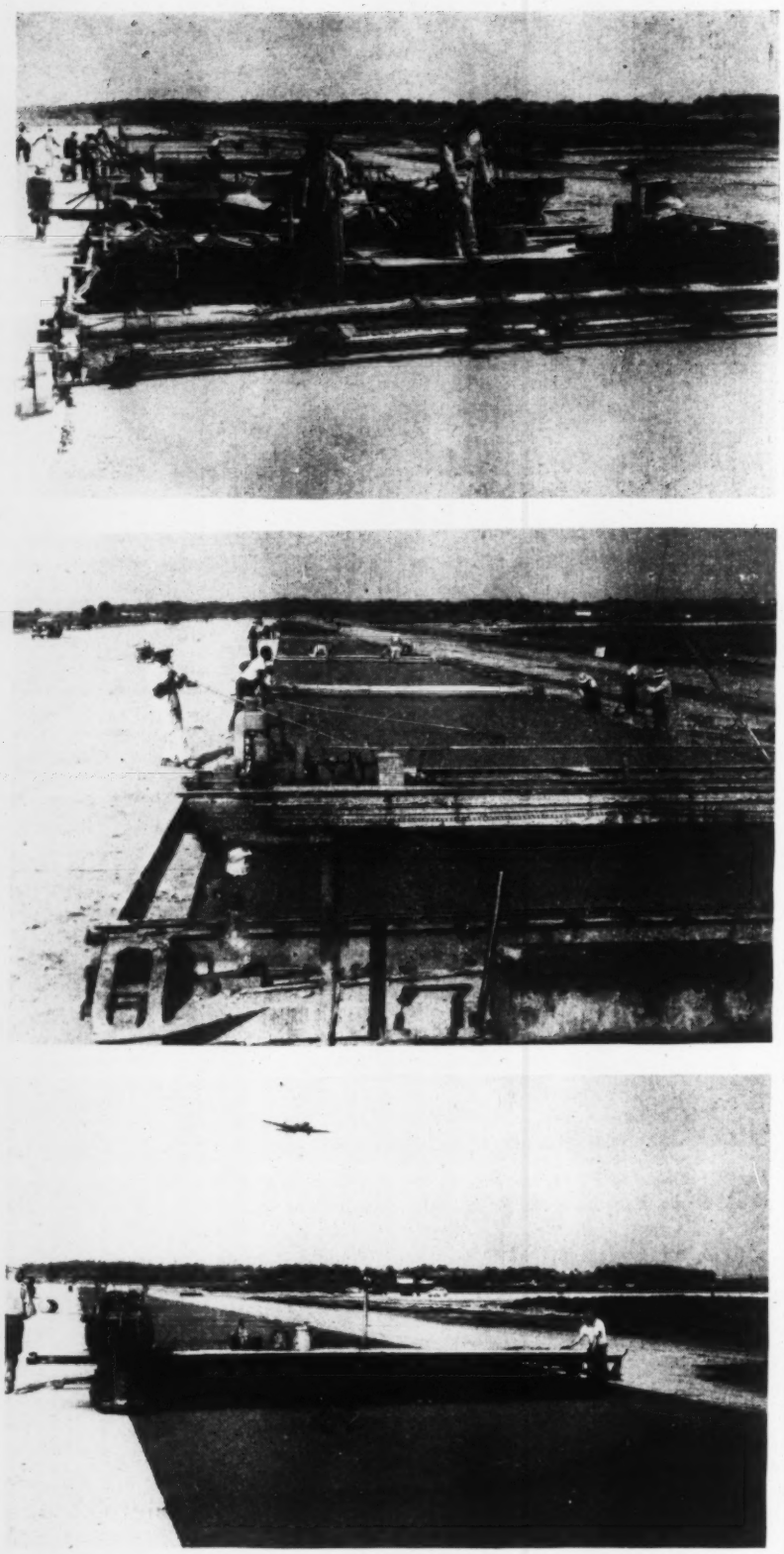


Fig. 8. Finishing operations included two finishing machines each equipped with external pipe vibrator (top), and longitudinal screed, hand finishing with wooden screeds and burlap drag, and hand troweling of joints (center). Final treatment (bottom) was to spray the completed pavement with a curing compound.

by a patrol grader, and light rolling with a 5-ton three-wheel roller.

Production and handling of aggregates was given equal consideration in the over-all organization of this large-scale paving project. Fortunately all aggregate, except a relatively small amount of fines, was available at a nearby gravel deposit. It was produced under a subcontract, screened and washed, with the fines being crushed in a ball mill, and delivered by a series of conveyor belts to stockpiles adjacent to the contractor's batching plant.

An endless belt, operating in a 6½ x 7½ x 390-ft. concrete culvert beneath the stockpiles charged four 100-ton bins with sand and ¾-in., 1½-in. and 3-in. aggregate. Bulk cement was delivered by hopper car, hauled to the batching plant in weather-tight trucks and elevated into two 400-bbl. and one 300-bbl. cement bins. Two-batch dump trucks hauled the cement and aggregates to the three pavers operating as a central plant and to the two pavers working in tandem beside the runway.

The welded fabric reinforcement was delivered in 7 ft. 3 in. width rolls to a straightening machine, cut by hand into 24½-ft. lengths and hauled to the job on flat-bed, steel-frame farm wagons. It was unloaded and placed by hand on the first pouring of concrete, just ahead of the second paver, lapped 6-in. and tied together with ordinary hog-rings.

Two trucks, mounting 1,200-gal. tanks, delivered water to the two pavers at the runway. The central mixing plant was served by a 3,000-gal. elevated tank. An air-entraining agent, required by specifications, was added at the pavers at an average rate of 1¾ oz. per bag of cement, producing from 3 to 3½ percent of air.

Concrete mixes

Specifications did not require compression tests on the concrete, but it had to show at least 700 psi. in tension, at 28 days. The theoretical design mix, by weight, was 1 part cement; to 1.80 parts sand; to 4.75 parts aggregate. The cement yield ran 5½ bags per cubic yard of concrete, with an average water-cement ratio of 0.63.

Typical mix by weight of a 37.4-cu. ft. batch (standard 34-E batch increased 10 percent as permitted under

the specifications) was: 716 lb. cement; 1,290 lb. sand; 1,010 lb. of ¾-in. aggregate; 1,700 lb. of 1½-in.; 680 lb. of 3-in. stone; and 300 lb. of water. Gradation of sand (percentage by weight passing numbered screens) was: 100 percent, #4 screen; 81.4, #8; 58.3 #16; 39.7, #30; 13.1, #50 and 6 percent passing a #100 screen.

Modification of paving equipment

Although, in principle, the paving operations were similar to those found in ordinary runway construction or on highway paving jobs, considerable modification of equipment was necessary to accommodate the unusual thickness of the slabs.

It was necessary to raise both mobile pavers 6 in. to clear the steel forms. To do this, short lengths of 6-in. steel beams were inserted between the top of the supporting frame and the framework of the upper part of the mixer. Also, an hydraulic ram was mounted on each paving boom to close the concrete conveyor bucket after dumping, so it would clear the forms when being retracted to receive the next batch of concrete.

A plate-and-angle frame attached to the guide roller, operating on top of an adjacent lane of previously paved concrete, which controlled the final depth of cut of the motor grader, had to be extended to accommodate the thicker slabs. Similar modifications also were made to the subgrade planer, and to the toothed scratch-template that tested the smoothness, slope and proper elevation of the finished subgrade before placing the concrete.

Dumping of concrete expedited

Another job-made innovation adopted by the contractor to simplify and expedite the job was a steel-frame bridge for dumping the batches of concrete received from the central mixing plant. It operated immediately ahead of the front paver on small rubber rollers riding the edge of the adjacent lane of pavement and steel wheels riding on the steel forms. It was pulled by cables attached to a small rubber-tired tractor, and could be positioned to permit dumping in any desired location.

In making the first dump next to the previously placed lane of pavement, however, the end-dump trucks merely backed up to the edge of pavement and deposited their concrete directly into place. A wedge-shaped steel block prevented the trucks from backing too far.

Men in charge

The VVHB runway, taxiways and warmup area were designed for the U. S. Army Air Forces by the Louisville District, Corps of Engineers, under the supervision of Col. B. B. Talley, district engineer. Robert R. Philippe is director of the Corps of Engineers' laboratory at Cincinnati. Contractor on this $5,000,000 project was the W. L. Johnson Construction Co., Columbus, Ohio. Aggregate was produced by the Central States Construction Co., LaCrosse, Wis.

For the contractor, Fred I. Rowe is general manager and Ralph Beerbower was resident manager. Construction superintendents on the job were: P. S. Scott, drainage; R. W. Craig, grade; Richard Tangeman, batching plant; D. H. Criswell, paving; and L. P. Thiel, electrical work.

Col. Geo. N. Kibler was officer in charge, and Maj. O. M. Haney, acting officer in charge. F. G. Dyer was project engineer; James L. Alexander, assistant project engineer; H. P. Caldwell, engineer of materials; and P. J. Clemens, concrete proportioning engineer.

How a Publicity Campaign Won Support for Sewer Bonds

Postcards, illustrated letters, car-bumper strips, street banners, and newspaper ads were used successfully in Modesto, Calif. as advertising mediums to promote voter-approval of bond issues for sewage-works improvements. The result was an 11 to 1 endorsement—and the first bond issue for sewage facilities to be voted since 1923.

Postcards showing a picture of inadequately treated sewage flowing into the Tuolumne River as well as a letter containing a photographic story of the city's domestic and industrial waste problems and a colorful folder explaining the proposed methods of financing were sent to every householder in the city.

Three thousand bumper strips were distributed to automobile owners through filling stations and industrial personnel departments. Six 25x4 ft. street banners, advertising the election, were displayed at busy intersections.

A series of informative radio addresses in which the mayor, council members, the city engineer and Chamber of Commerce officials participated were delivered over the local station. Full newspaper ads explaining the bond issues were run each week in four papers.

By means of explanatory letters, endorsement of the program by every social, civic, fraternal and religious organization was solicited. In addition, Chamber of Commerce officials conducted a house-to-house survey during which technical and financial issues were explained to housewives. A similar canvass was made of industrial plants and retail businesses. Calls were made upon professional and civic leaders in the community. To dramatize the issue, the film "Clean Waters" was purchased from the General Electric Co. and shown to over 50 groups. It was estimated that more than 2,000 persons saw this picture.

On election day, every voter that could be reached by telephone was contacted, urged to vote and offered free transportation to and from the polls. This service was furnished from 7 a. m. to 7 p. m.

As a result of this educational campaign, projects for domestic sewers and enlargement of sewage disposal facilities to cost $738,000 and for industrial sewers and a waste treatment plant to cost $613,000 as well as a proposal to increase water storage facilities were approved by a vote of 11 to 1.

All expenses were borne jointly by the retail business men and local industries. No public or Chamber of Commerce funds were used to defray advertising costs.

Experience Guides Ocean Outfall Design

***Contents in Brief**—Design and construction of a 72-in. ocean sewer outfall recently completed for the Los Angeles County Sanitation Districts were patterned closely after a parallel line built some 10 years ago. Experience gained on the early work and close observation of the behavior of that line in service enabled the same group of engineers to conceive and construct a larger line with minimum difficulty. Major design differences involved joints, manhole spacing, and length of pipe sections. Pipe for the new line, which extends some 5,000 ft. into the ocean from the California coast, was placed entirely from a barge.*

PRINCIPAL design changes for a 72-in. ocean outfall for the Los Angeles County Sanitation Districts as compared with a 60-in. line built some ten years ago lie in joint detail, spacing of manholes and length of pipe sections. Abandonment of the flexible-type joint used in the old line (described in *ENR*, Mar. 11, 1937, p. 369) resulted in simpler construction procedures. Both jobs were directed by the same engineers and construction men who were able to adapt experience in building and operating the old line to work on the new one.

The Los Angeles County Sanitation Districts which serve cities and unincorporated areas outside of the city limits of Los Angeles proper is currently handling a flow of some 70 mgd. This is far beyond the system's design capacity (prewar flow 20 mgd.). Steps are being taken to increase the capacity of the system to 150 mgd. Construction of the new outfall is one of the first of these steps.

Flexible joint abandoned

Because of the failure of many ocean outfalls on the California coast due to parting at joints, the original line was constructed using flexible, ball-and-socket-type joints. These joints were used every 12 ft. in the transition section (Stations 27+00 to 22+00) and every other joint in the section laid on the ocean bottom. Alternate joints were of a more rigid type. Care taken in design and construction of this first line paid dividends as is shown by the record of no known leaks.

Plans for the new work originally called for similar flexible joints about every 50 ft. However, a careful study of the existing line indicated that there had been no movement in these joints since the pipe was placed. Records of other outfalls showed that where joints parted it was during or soon after the construction period. Accordingly, the conclusion was reached that fully flexible joints were unnecessary in the new work. It was felt that by using careful construction methods and employing close underwater inspection, the line could be placed without subsequent movement at the joints.

Another factor ruling against use of the universal-type, flexible joint was the extremely high cost under current market conditions. This was caused by machining of joint castings to insure perfect spherical shape of both ball and socket ends. Besides this, such a joint requires outside caulking, a very difficult operation requiring 40 to 48 hours of diver work.

Improved rigid-type joint

The less flexible type of joint adopted was an improvement over its counterpart in the old job. In caulking these joints from the inside, the lead gasket used has a fiber center. On the old job a rubber gasket similar to that used in Lock-Joint pipe was used. Experience on the first line indicated that the rubber gasket was unnecessary and it was not used on the new construction.

The metal in the old joint was Mee-

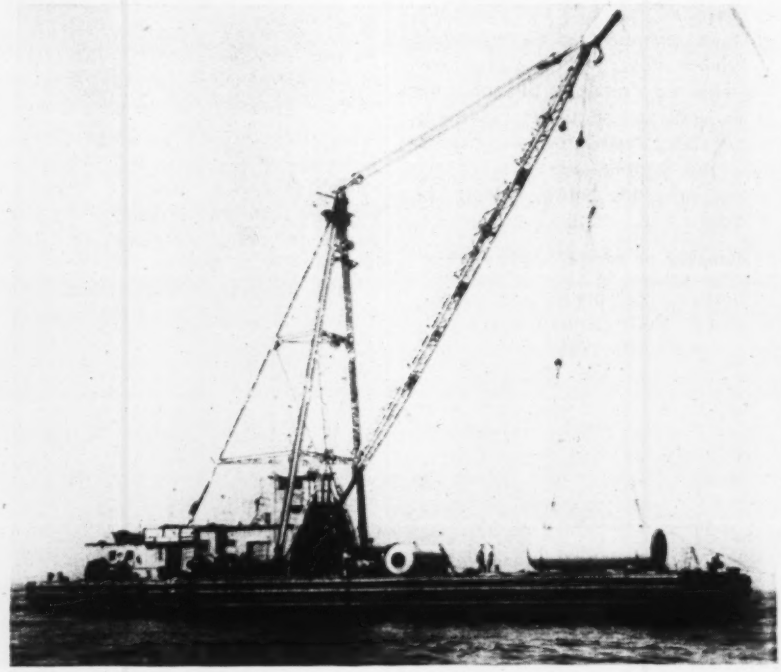


Fig. 1. Pipe for the 72-in. outfall was laid from this 50-ton barge. A 24-ft. pipe section is ready for placing.

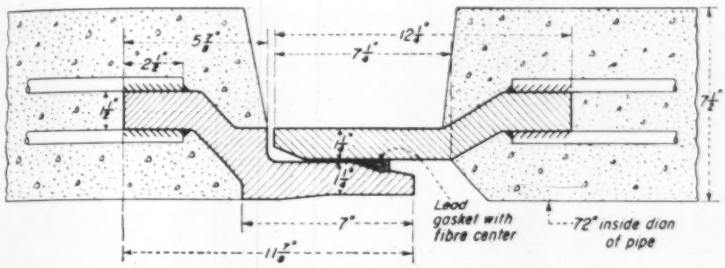


Fig. 2. A rigid-type joint was used. A careful check of the old line indicated absence of movement in flexible joints. Caulking of the joints was done by a diver working inside the pipe.

hanite—a cupola cast iron graphitized with calcium silicide. This provides high strength and resistance to corrosion. It also allows reinforcing bars in the spiral cage to be welded directly to the bell or spigot joint ring.

For the joint rings on the new job, 40,000-lb. gray cast iron alloyed with copper molybdenum and chromium was used. This had the advantage of cheaper cost and it also served all other requirements. If anything, the new joint was more easily welded to the cages of spiral reinforcing because of improvements in welding rods and equipment.

On the original job, because of the difficulty that had been experienced with ocean outfalls, manholes were spaced some 187 ft. apart so that inspection and repairs could be made readily. However, this conservative step was not felt necessary in the new line because of the success with the old line. Accordingly, manholes were spaced on 432-ft. centers. No particular improvement in manhole design was made for the new outfall.

Specifications for the new work called for 18-ft. lengths of 72-in. inside diameter pipe for the offshore end of the outfall. Similar lengths of 60-in. pipe were used in the first job. However, when it was learned that a local pipe manufacturer could make pipe 24-ft. long, that length was adopted.

Primary advantage of longer pipe sections is that fewer joints have to be made. The additional length involved does not cause any appreciable handling problems. Pipe sections are made some 25 miles inland; hauled to Long Beach, Calif., where harbor facilities are available; loaded on a barge that takes them to the job; and, finally, placed by a barge-mounted crane. Equipment used in all these steps is capable of handling the increased length and weight.

The 24-ft. pipe sections warrant special mention. It is believed this is near record length for precast, poured-on-end, reinforced concrete pipe. The pipe is 7½ in. thick and has double cages of spiral reinforcing. It was made by a method similar to that used for pipe on the San Diego Aqueduct (ENR Mar. 20, 1947, vol. p. 459).

Layout similar to old job

The new line, located some 200 ft. east of the old one, follows a similar plan and profile. The two outfalls discharge in a depth of 110 ft. of water where ocean currents carry the effluent offshore. This is a distinct advantage over many other California outfalls that, even though nearly a mile long, discharge in only 50 ft. of water with unfavorable currents.

When the first outfall was built some 10 years ago, two 5-ft. dia. lines were laid from the shore through the surf. One of these was extended 5,000 ft. from the shoreline and the other was blanked off some 589 ft. out. The new 6-ft. dia. line just completed was started at this point.

The work started at Station 43+11 (Station 0+00 is at the ocean end of the line) and was constructed in excavation for 1,611 ft. A 500-ft. transition section brought the line up to the surface of the ocean floor and, for the last 2,200 ft., the pipe rested on the sandy bottom. At Station 13+11, the ocean bottom was slightly more than 20 ft. below mean sea level and, with excavation averaging 10 ft., the pipe invert was some 30 ft. below sea level.

Specifications called for that portion of the outfall in rock excavation to be built of 8-ft. lengths of centrifugally spun, reinforced concrete pipe. Two lengths were joined together at the dock site and, after being transported by barge, were lowered into the trench using a strong-back to prevent joint slippage. Under-

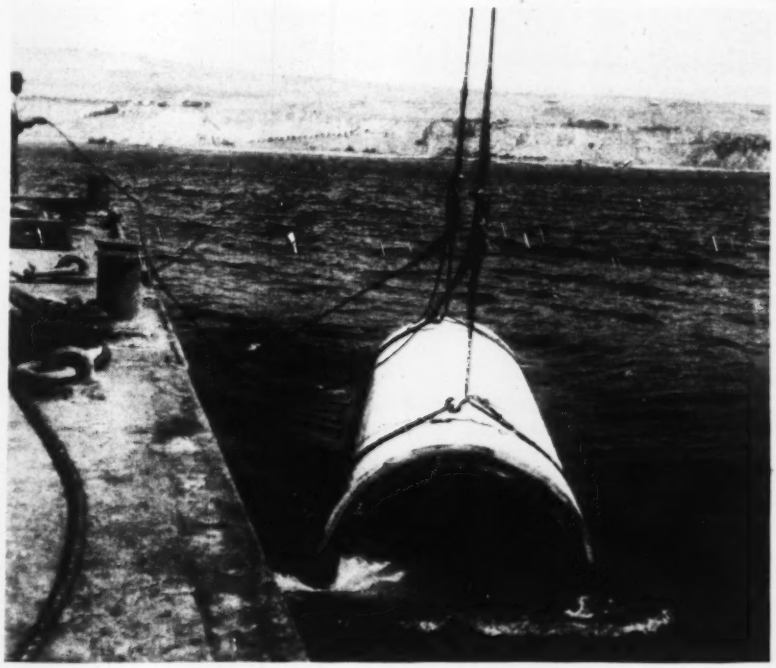


Fig. 3. To lower pipe sections into the water, they were suspended by slings. No pontoon support was used as in the previous job.

Fig. 4. After the pipe sections were under water, divers directed the work. They maintained communication with their attendants by means of radio.

water, a temporary lead-wool joint was made with the next two-length section. These joints were strong enough to resist surges in the line during construction until a concrete seal was poured by the tremie method to fill the trench and cover the pipe. Encasing the pipe in tremie concrete fully closed the temporary lead wool joint.

During laying of the 8-ft. pipe sections in excavated trench, studies were made of underwater currents and the amount of scour that would affect this section of the outfall. It was then decided that there would be little or no scour at this depth and the 24-ft. pipe lengths with metal joints could be used in the trench section without a tremie seal. Accordingly, only 880 ft. of 8-ft. certrifugally spun pipe lengths was installed. The remainder of the line was made of the 24-ft. lengths, including the diffuser section at the end.

Barge key to job success

In placing the large sections, a 50-ton steel barge equipped with a derrick boom was the key to the success of the construction operations. Maneuverability of the barge was provided by four winches, each attached to an anchor line extending outward from one corner. As the job progressed, moorings were moved outward to new positions.

In placing pipe lengths, a section was first lowered in place by means of the derrick on the barge. The barge was maneuvered so the shore end of the pipe (bell end) was directly opposite the last section placed.

Where laid on sandy bottom, the pipe could be dropped short distances to get extra depth to insure correct grade and alignment. After the pipe was positioned, the slings were removed leaving a clip on the offshore end attached to the barge by means of a winch line. Another line attached to a powerful winch on shore was used to seat the pipe when a signal was given. The crew became so proficient that in two 8-hour shifts, as many as six 24-ft. lengths were placed.

Operation of the derrick and winches on the barge was controlled by divers working by touch only in underwater blackness. Communication was maintained by radio so connected that two or three divers could be under water at one time. Because Federal Communication Commission regulations permitted only short range radio, contact with the winch operator on the shore was maintained by means of whistle signals.

After the pipe lengths were seated, a diver caulked the joint from the inside with a pneumatic caulker. This operation required about one hour.

The method used in placing pipe differed from that used 10 years ago in that, on the old line, two sections of pipe were placed at one time and pontoons were used to provide extra buoyancy. As rigid-type joints and flexible-type joints were alternated on the old line, two pipe sections were placed at one time. This allowed the intricate flexible joint to be made in the dry. The weight involved in placing two lengths at one time was such that a pontoon cell shaped to fit the top of the pipe was used to provide better control during placing.

Underwater excavation

The first step in construction was excavation of the trench. This was done by a grab-type bucket rigged on the derrick boom. The rock spoil was disposed of by side casting. When necessary, rock was blasted by use of underwater bombs similar to those used on the original job and of the type first used on underwater excavation for the Golden Gate Bridge (*ENR* July 27, 1933, p. 93).

A special barge was used to pour the tremie seal. This barge carried a supply of sand, gravel and cement. When these supplies were depleted.

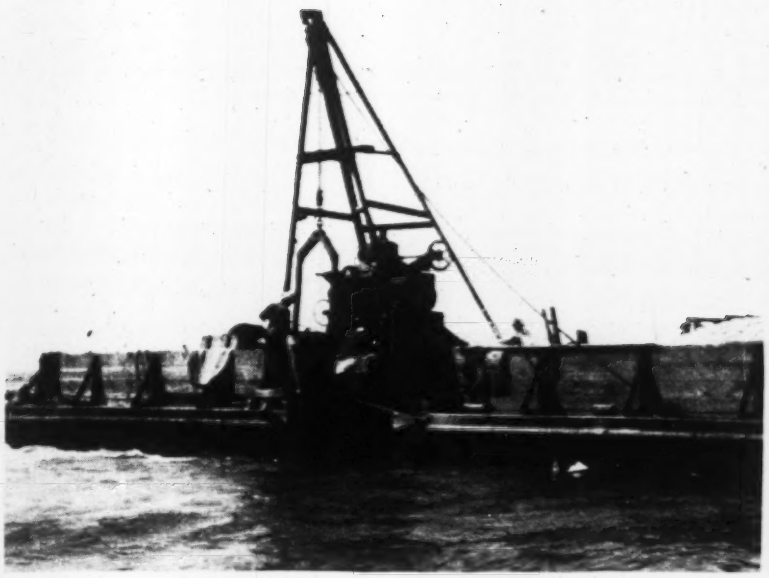


Fig. 6. This barge carried equipment and materials for pouring concrete by the tremie method to embed the inshore end of the outfall.

Fig. 7. Sand and gravel for the tremie seal were loaded into the mixer by this rubber-tired tractor.

the barge was taken into a dock for refilling. A 1:3:5 mix was used for tremie concrete with extra sand provided to insure flowability.

A 16-in. tremie pipe extended from barge to trench. When a new pour was started, an inflated rubber beach ball, the size of the pipe, was inserted and the concrete poured on top of that. This sealed the concrete from the water until the ball was forced out the bottom and the concrete started to deposit on the pipe. Ocean saltwater was used in mixing the concrete as no steel or other metal was exposed to the tremie seal. Depth of the trench was some 10 ft. and about 1 ft. of tremie fill covered the pipe.

Part of $14 million development

The outfall is part of a development program totaling some $14,000,000 which the Los Angeles County Sanitation Districts now have under way. Need for this development is due to increasing population and industry in the area served by the districts and annexation of districts which include the city of Long Beach and portions of the San Gabriel Valley.

The existing 60-in. dia. outfall was a bottleneck on the system, so the new outfall was one of the first steps to be taken. Sewage treatment plant expansion and construction of new main connecting lines are now under way. Included in the proposed program is an additional tunnel under the San Pedro Mountains connecting the treatment plant and outfall. It is expected that the contributing population to this system will soon be some 3,000,000 people.

Many communities served

The thirteen county sanitation districts in Los Angeles County cover an area of more than 400 sq.mi. and have a present population of some 1½ million people. They comprise all or portions of 35 incorporated cities and many densely settled unincorporated communities. A single joint administrative office is operated and each district contributes to the cost of the services rendered in proportion to the value of the works constructed. Cost of the outfall is being apportioned among the districts according to the volume of sewage contributed.

Work on the outfall was done by the districts on a force account basis with the barge and other floating equipment being rented. This was necessary because of the scarcity of qualified bidders for this type of work and because of risks inherent in offshore work that would oblige contractors to include large sums for contingencies. The districts had available competent and experienced supervisory personnel with which construction risks could be held to a minimum.

The work progressed smoothly despite the usual winter storms. The new outfall was placed in operation in October, 1947, with some finish work left to do. It is expected that the total cost will be $700,000.

A. M. Rawn is chief engineer and general manager of the Los Angeles County Sanitation Districts, in charge of the work. C. R. Compton is assistant chief engineer. F. D. Bowlus was resident engineer on the project and Dan Boom was master diver and construction superintendent. All held positions of similar importance on the original work.

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Construction Noise

Sir: Looking at page 40 of October 30, *Engineering News-Record* showing picture of sign placed by P. J. Walker on a Los Angeles building in which Mr. Walker quite properly apologizes for the "unavoidable annoyance" caused by riveting hammers, makes me feel that Mr. Walker must be aware of the fact that he could have constructed this structure as a welded job and not caused any "unavoidable annoyance".

It is interesting to observe the working of influences of welding, when not too many years ago the public could take the noise of riveting and like it, so far as any contractor was concerned.

VAN RENSSELAER P. SAXE
Consulting Engineer,
Baltimore, Md.

Building Unjustly Criticized

Sir: I have just read the article by Harry A. Cobden, chief building inspector, Berkeley, Calif., on "A Building Official Looks at Codes." (*ENR* Dec. 11, 1947, vol. p. 800). I wonder where he gets the information on which he bases his statement that "Housing is the most expensive thing we buy today and it has always been so. If we paid in the same proportion for any other commodity or consumer goods today that we pay for houses, we would indeed be hard put as a nation." I would suggest that Mr. Cobden get the statistics on building costs and he will find that, despite the very great increase in the cost of building materials, the increase in the cost of building is proportionally less than it is for a great many other commodities.

Furthermore, he overlooks the important point that those who build are not necessarily the only factors in the cost of a building to the ultimate purchaser. We discover on examination that the cost of land has risen tremendously due to the willingness on the part of the American public to secure a profit if it is handy and no matter how large it may be. We also find that there are a great many builders taking what appears to be an exceptionally high markup over their costs—just as is the case in practically every other industry in which the demand exceeds the current supply.

There are so many other points in Mr. Cobden's paper which fail, because they lack certain essential elements, to make them correct, that I cannot help but call your attention to an address by Robert W. McChesney, chairman of the committee on policy, Construction Industry Advisory Council of the Chamber of Commerce of the United States, at its meeting on Nov. 19 (See *ENR* Nov. 27, 1947, vol. p. 715). Unlike Mr. Cobden, Mr. McChesney looks at the statistics from a number of angles and gives statements in their true perspective.

As a matter of fact, I seriously question some of the figures which have been published from time to time on the need for new houses. A great many people who claim they have a need for new homes would not buy them even if they could obtain them at a "reasonable" price, but would instead invest their funds in some other type of commodity—automobiles for example, as they did before the recent war.

I feel that the building industry is doing a mighty fine job, despite the so-called lack of modernity of building codes, in providing new homes for our people. All that Mr. Cobden and others who shout from the housetops will accomplish is a tendency to nationalize the building industry as is being done in England, and I wonder, if that is accomplished, whether the detractors of the building industry will be satisfied. Of course, there are a great many ills in the building industry, but the same is true in practically every other. However, it is the building industry, because of its "small business" status, which seems to be drawing all the fire.

In connection with the small operator status of construction, I feel, on the contrary, that the building industry is one of the few remaining in which a young man can begin by learning a trade and become an entrepreneur, and I believe it is very fortunate for this country that the condition exists. The fact that an industry is big or is made big by large capital venture is no indication that low cost production will result.

ERWIN M. LUTH
National Foundation for Lathing and Plastering, Inc.
Chicago, Ill.

Composite Girder Bridges

Sir: The writer wishes to make several comments on the discussion of composite girder bridges by Louis Balog (*ENR* Jan. 8, vol. p. 64).

In bridges and other structures having concrete decks resting on steel stringers, composite action between the concrete and the steel must never be considered in the design unless adequate shear connection is provided. Certainly, as was pointed out, deflection measurements show that many floors of this type without shear connectors act as composite structures. But it would be deceiving to always expect this action.

With conventional bond-stress values, the bond between the concrete and steel is entirely insufficient to carry the horizontal shear. It would be irrational indeed to design a composite section with little or no factor of safety in transmitting the shear and the usual factors of safety in the remainder of the section. Composite sections should be properly proportioned and the necessary shear connectors provided.

Commenting further, it is not surprising that the load tests made on the three conventionally designed German bridges indicated composite action. The applied loads were evidently less than the actual design loads and considerably less than the design loads if composite construction had been used. Thus, this relatively light applied load did not break the bond between the slabs and girders.

Not only the horizontal shear due to the applied loading, but also shrinkage and plastic flow in the slab, torsional stresses and slab uplift, contribute in destroying the

bond. If shear connectors, such as spirals, are provided, tests show that the bond strength between the slab and girder can be considerably increased, even though the entire shear is considered to be carried by the connector.

Although many composite beam bridges have been designed and built in the United States and Europe, only one of the six bridges mentioned by Mr. Balog, the Cattaraugus Creek bridge (*ENR* Dec. 26, 1946, vol. p. 856) is a composite structure. Not a new type of bridge, it is, nevertheless, significant as one of the longest deck-girder spans using composite construction yet designed in the United States. With all-welded girders at 9-ft. 4-in. spacing, this bridge is an important contribution to the bridge engineering profession.

The increasing use of composite design certainly merits consideration. Since measured stresses and deflections agree with theory, there is no doubt as to its functioning according to design. On the other hand, with the old slab and stringer type, dependence on bond leaves too much to chance.

Comparative designs prove that composite sections not only are more economical, except for short-span bridges, but also that their moments of inertia are considerably greater, reducing live-load deflections and vibrations. At the same time, shallower construction, so vital in many grade separations and other structures of the modern highway, can be attained.

DAVID H. CRATER
Essex Fells, N. J.

Truck Damage to Highways

Sir: We read with interest your editorial "Truck Damage to Highways" (*ENR* Dec. 25, vol. p. 858). As subscribers to your publication for years, we wish to endorse your suggestion that a test track operation be required.

You also had an article in the Nov. 27 issue, vol. p. 731, "Old Concrete with good Record", where 40 year old concrete is described by H. S. Mattimore. In this he gives credit to the aggregate, diabase trap rock. Mr. Mattimore was formerly engineer of tests for the Pennsylvania State Highway Department and certainly knows what superior roads diabase trap rock produces. The reason diabase trap rock gives such superior performance will be found in tests made by the U. S. Engineers and published on page 997 of the May, 1947, issue of the *Journal* of the American Concrete Institute.

C. F. MOHR.
Kingston Trap Rock Company, Kingston, N. J.

Cutting the Federal Budget

Sir: We should like to comment on the editorial, "One Place to Cut," in your Jan. 22 issue, vol. p. 102.

The editorial states that the President's budget includes $663,000,000 for civil works of the Army Engineers and $461,000,000 for the Bureau of Reclamation.

We are not familiar with the needs and plans of the Bureau of Reclamation, but feel on safe ground in discussing the amounts provided in the budget for flood prevention and waterway improvements. The editorial states that, "Few, if any, of these new projects are so badly needed as to warrant their start at this time when everyone knows that they must compete with more urgent work for men and materials, thus helping to push construction costs higher. Consequently, these projects provide an excellent opportunity to put into practice the much discussed theory that public works should be used to stabilize construction, being expanded in bad times and curtailed in good times."

With respect to deferring flood-control improvements until bad times, we should like to point out that floods, often causing losses running into millions and disrupting commerce and traffic, do not wait until bad times. You will agree, we believe, that the earlier preventive work is done the more economical and beneficial it will be, from every point of view.

We have no accurate knowledge with respect to the number of new and partly completed navigation improvement projects in the budget recommendation. We believe, though, that most of them are expansion or development projects, rather than altogether new ones. There are many harbors, berths, anchorages and navigation channels, completed from a few to many years ago, that are now unfitted for the deeper draft vessels in use today, both commercial and naval. As Theodore Roosevelt said many years ago: "A channel is no deeper than its shallowest reach." Of course, what the former President said is true of all waterways. Narrow and shallow reaches in waterways are something like short stretches of 36-in. gage would be in the mileage of a standard-gage line.

Waterway maintenance is as necessary as railway or highway maintenance, else, the facility is seriously impaired or becomes useless. Waterway maintenance was seriously neglected during the war years; the Army Engineers are now trying to catch up on it, but the $53,000,000 recommended in the budget won't go very far—the federal waterway system is nation-wide.

The $107,350,000 recommended for new work spreads out thin indeed when distributed along the Atlantic, Gulf and Pacific coasts, the Great Lakes, inland waterways and rivers.

We believe that $160,000,000 is a very reasonable annual expenditure towards the improvement and maintenance of the federal waterways—vital and indispensable both in peace and in war.

There are many types of public construction which can well be deferred, without loss of any kind, until unemployment is a grave problem.

HAROLD J. HARDING.
Secretary, The Propeller Club of the United States, New York, N. Y.

Rhine Bridges

Sir: In the tabulation of Rhine bridges in the article in the Oct. 30, 1947 issue, vol. p. 593, the Duisburg-Hochfeld highway bridge is given as consisting originally "of two truss spans of 500 and 850 ft." Have you any more information on this unusually long-span structure?

D. B. STEINMAN
Consulting Engineer, New York

EDITOR'S NOTE: The important additional information is that the tabulation is in error. The bridge contains four spans instead of two and is shown correctly in Fig. 19, p. 599 of the same article. The four spans are continuous and are 169-337-675-169 ft. long respectively.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Pointer Aids Alignment On Asphalt Paving Rig

Difficulty in maintaining true line with a self-propelled asphaltic concrete paver prompted the contractor and resident engineer on a California highway job to work out an aid to good alignment. This aid took the form of a 6-ft. extension made of steel channels and mounted on the paver on the operator's side. A pointer was suspended from the extension and the distance of the pointer to the side of the paver made variable by means of a set screw. By maneuvering the paver so the pointer, which could be easily seen by the operator, was kept directly over a chalk line, good alignment was maintained.

This device was worked out by Basich Bros., contractors, and C. G. Gates, resident engineer, on a highway job near the Mojave Desert in south-central California. The Adnun paver was used on this work, but it is believed such an arrangement is readily adaptable to most paver models.

Pointer suspended from 6-ft. extension mounted on self-propelled paver helps operator follow chalk line and thus maintain alignment.

Sheetpile Rings for Sand Boils

Ringing sand boils with 6-ft. lengths of corrugated steel sheetpiles have been found to "contain" the boil at an expenditure of 25 man-hours compared to about 450 hours for the currently used sand-bag procedure. Developed by Kent Saxon, a civilian construction foreman of the New Orleans District, Corps of Engineers, the method is expected to save three-fourths of the usual costs.

Sand boils develop on the land side of levees or earth dams during protracted high-water periods. Water percolates through the earth and starts to flow from some weak spot in the soil, usually at the "down-stream" toe of the slope.

A 10-ft. 2-in. dia. circle is scribed around the boil and a 6-ft. sheet driven down about 15 in. Other sheets are interlocked into it to complete the circle. The sheets are hand driven with a 16-lb. maul. The sheetpiles are in no sense a cut-off but extend nearly 5 ft. above the surface to retain water and build up a head sufficient to retard the flow so that the water does not carry dangerous quantities of silt and sand. The 10 ft. dia. circle will suit almost any boil, but can be increased to a larger size.

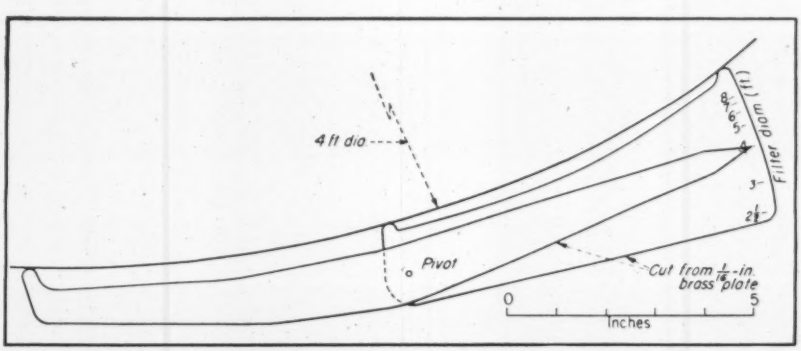
Filter Diameter Caliper

Sanitary surveys of the 500 public swimming pools in Illinois by engineering personnel of the Department of Public Health presented the problem of gathering factual data on the water treatment facilities at each pool.

The illustrated filter diameter caliper was developed for this purpose, since cramped quarters and appurtenant pipes at many of the pressure filter installations interfered with and made direct tape measurement difficult.

The caliper is of $\frac{1}{16}$-in. brass plate, the two arms being joined with a small bolt at the points marked "pivot." Graduations are in feet.

The instrument has proven quite useful. Readings are taken at several points around the filter shell, and averaged, since many of the older filters vary considerably from a perfect cylinder.—J. G. SIEG, *Senior Sanitary Engineer, Illinois Department of Public Health*



Made of 1/16-in. brass plate, a caliper placed against the circumference of pressure filters measures the diameter directly.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

Statistical Analysis

TECHNIQUES OF STATISTICAL ANALYSIS—By the Statistical Research Group, Columbia University. 473 pp. McGraw-Hill Book Co., New York 18, and London. $6.

It is well known that statistical methods can be applied to civil engineering research, particularly in the fields of hydraulics and materials. In this regard, the preface to this book makes the statement that the chemical, physical, and engineering sciences are, on the whole, distinctly backward in the statistical planning of experiments and the analysis of empirical data. Accordingly, the book, the outgrowth of a government-sponsored wartime project, undertakes to explain statistical approach by relating examples of how various research or quality control problems are carried out and the statistical methods and theory brought to bear on them.

However, researchers in civil engineering fields will find it difficult to use the information presented unless they have much more than an ordinary background in statistical methods.

Army Amphibian Engineers

DOWN RAMP—By Brig. Gen. Wm. F. Heavey. 272 pp., Infantry Journal Press, 1115 17th Street, N. W., Washington 6, D. C. $5.

To all engineers who took part in World War II this well written story of the important work of the Amphibian Engineers, Corps of Engineers, U. S. Army, should be very satisfactory reading. It also will be found to contain much of interest to engineers and construction men who did not get into the battle areas to see first hand the important part the Amphibian Engineers played in landing troops on enemy shores.

Outstanding innovation of the Engineer Amphibian Command was the integration of boat engineers and shore engineers, with supporting boat maintenance, signal, ordnance and quartermaster troops, into a balanced team, the only undertaking of its kind in any of the Allied armies. These troops were trained first of all to fight, but they were also given the difficult task of unloading Allied forces on enemy-held open beaches all the way from North Africa to Okinawa. Their work required careful engineering planning.

Starting with the paper organization of the Amphibian Engineers, the book quickly tells of their actual organization and specialized training and equipment, and then describes all of the landing operations in which they were to take part. In this latter writing the author has been able to bring in extensive detail without making this active story slow reading. The maps provided also add appreciably to the story, and the material collected in the appendix also adds considerable value.

Doing Business Abroad

GOING ABROAD FOR BUSINESS—By E. B. Besselievre. 242 pp. Reinhold Publishing Co. New York 18, N. Y. $4.

Mr. Besselievre knows whereof he writes in this most useful volume. Even if one did not know of the many years he spent representing the Dorr Company in foreign lands, reading this book would impress his familiarity with foreign service indelibly on the reader's mind.

And how important foreign service is today! Probably at no time in our history have business, industrial and commercial interests, as well as individuals, been so foreign-trade minded. The development of our exports and imports is becoming a more and more controlling factor in our economy. Mr. Besselievre tells the employer who wants men for foreign service, and the employee who is considering work in foreign lands, just what they need to know. Thousands of us here in the United States are going, and more will go overseas to establish or work in agencies, or on construction, or engineering, or to operate plants. These men are very important to those who stay at home and the better they are prepared for their overseas life, the better for this country and hence for those who stay at home.

This story is simply told and is so interesting that it is quickly read and assimilated. I have been overseas as representative of a U. S. corporation and have been an employer who has sent men to several parts of the world. I know from first hand experience before the war and since, that Mr. Besselievre knows what he is talking about. To a young man contemplating overseas service this little book will be not only interesting but exciting. To both employee and employer I say read it, keep it with you!

The employer will find in Mr. Besselievre's book excellent advice regarding the selection of foreign representatives and also, very important, how to handle them from the home office when they are overseas. Misunderstandings between the home office and the field can and do develop easier when the field is far away. Some men will fit in quickly in foreign service, and will develop and become extremely valuable, while others will go to pieces. It is hard to determine how overseas service will react on a man.

Mr. Besselievre very wisely cautions us against making comparisons when we are in a foreign country with United States standards of living and ways of doing business. He knows and points out the heart-breaking delays and postponements that foreign representatives must endure; the strange, to us, customs and practices that we must accustom ourselves to.

He urges young men who contemplate foreign service not to go out on their own. Don't go to Brazil, for example, and look for a job after you get there. Get a job with a U. S. company, which will send you there as a part of its organization. And he also urges them not to go for a short period, but to go to stay, to make it their life's work. To be of the greatest service to your company, and to make the greatest success of your own life, a foreign representative should make up his mind to devote his business life to living abroad. In this connection, Mr. Besselievre says a man should have the right kind of wife. She should like travel, enjoy new experiences, make friends, be ready to entertain her husband's business friends and clients.

The chapters on contracts between employer and employee who is going

overseas; on the necessary preparation for the trip; the study of languages and history of the country he is going to, are practical, valuable and interesting. Other chapters on the cost of and way of living, house furnishing, servants, kinds of food, clothes, etc., are full of just the kind of facts a man and his wife need and want to know before they start.

Mr. Besselievre, of course, realizes the important part that foreign service men are to play in our future economic status and impresses on the reader that by their efforts they may help to raise the lower standard of living that usually exist in other lands, and thus develop greater markets for our products and outlets for the investment of U. S. funds. *Reviewed by* FARLEY GANNETT, *President, Gannett Fleming Corddry & Carpenter, Inc., Engineers, Harrisburg, Pa.*

About Many Subjects

NATURAL PHILOSOPHY OF THE SCIENCE OF PHYSICS, CHEMISTRY AND ENGINEERING—By C. A. P. Turner. 320 pp. Privately published by the author, 964 N. High St., Columbus, Ohio. $6.00.

About two thirds of this book is given over to a presentation of the author's views on a variety of subjects in the fields of physics and chemistry. The remainder contains a discussion of the defects of the U. S. patent system and their effect on some of the early developments in reinforced concrete design, in which the author did much pioneer work, also a review of the author's studies of reinforced concrete design with Henry Turner Eddy. In the appendix the author sets forth his views on the "backward progress of America today."

Plastics Handbook

HANDBOOK OF THE SOCIETY OF THE PLASTICS INDUSTRY—451 pp. Society of the Plastics Industry, 295 Madison Avenue, New York 17. $7.50

Not generally classified as a construction material, plastics, nevertheless, seem destined to play an increasingly important role in the building field. A water-service pipe of plastic has been available for several years and a few wall-surfacing materials have been introduced. Civil engineers and constructors will be interested, therefore, in knowing that an authoritative handbook on plastics is now available.

Standard data on plastics-materials, processes and practice are brought together for the first time in this book, which represents the collective effort of 300 technicians in the field. This organization of information, heretofore widely scattered, is of primary usefulness to product designers and fabricators. But those concerned with selection and use of plastics, particularly specification writers, will find it of great value.

Miscellaneous Notes on Booklets and Reprints

TO ENCOURAGE ECONOMY of materials and effective wood construction, a 54-page booklet, "Technique of House Nailing," has been prepared by the Forest Products Laboratory in collaboration with the technical staff of the Housing and Home Finance Agency. More than 50 sketches illustrate recommended positioning and spacing of nails in various components of frame houses. Copies of the booklet may be obtained at 20c. each from the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

SWEDISH EXPERIENCES with wood stave pipes are told in a 76 page booklet *Erfarenheter Rörande Trätuber* by Stig Regnel. Design, construction, and operation of wood stave pipe lines are covered, also information on decay and freezing of such pipe. The booklet is compiled from experiences of 200 wood stave pipe users in Sweden. Text is in Swedish with an English summary. Charts and photos have full English description. The booklet is published by Svenska Vattenkraftforeningens Publikationer, Norrlandsgatan 16, Stockholm, Sweden.

AN INTERESTING DISCUSSION of the engineering work involved in developing the famous Comstock Lode at Virginia City, Nev., will be found in "Early Engineering Works Contributory to the Comstock" by the late J. D. Galloway. Development of wagon trails, railroad service and water supply to serve this desert location are outlined. Of foremost interest is the discussion of the riveted, wrought iron water supply line built in 1870 and subject to a head of some 1,900 ft. This report, written by an eminent engineer who spent part of his boyhood on the Comstock, is published some years after his death. Copies are available for 75 cents from the Nevada State Bureau of Mines, University of Nevada, Reno, Nev.

A HANDBOOK OF BRITISH STRUCTURAL SHAPES has been published by the structural engineering firm of Fleming Brothers, 49 Bath St., Glasgow (C2) Scotland. About 3 x 4 in. in size, its 600 pages present tables of all British shapes as well as design data relating to rigid frames and welded construction and many tables of examples and calculations for more conventional construction. Price 10s 6d.

New Engineering Books

ELEMENTS OF NOMOGRAPHY—First Edition—By R. D. Douglass and D. P. Adams. 209 pp. McGraw-Hill Book Co., New York 18, and London. $3.50.

HYDRAULICS—Fifth Edition—By H. W. King, C. O. Wisler and J. G. Woodburn. 351 pp. John Wiley & Sons, New York 16, Chapman & Hall, London. $4.

PRACTICAL MARINE ENGINEERING—By R. C. King, Jr. 470 pp. Prentice-Hall, Inc., New York. $6.

LIGHT METALS IN STRUCTURAL ENGINEERING By L. Dudley. 216 pp. The English Universities Press Ltd., London. $6.50. Obtainable through Stechart & Hafner, Inc., 31 E. 10th St., New York 3.

1948 OFFICIAL DIRECTORY AND GUIDE OF THE BUILDING CONSTRUCTION EMPLOYERS' ASSOCIATION OF CHICAGO, INC.—By Building Construction Employers' Association, 228 North La Salle Street, Chicago, Ill. 350 pp.

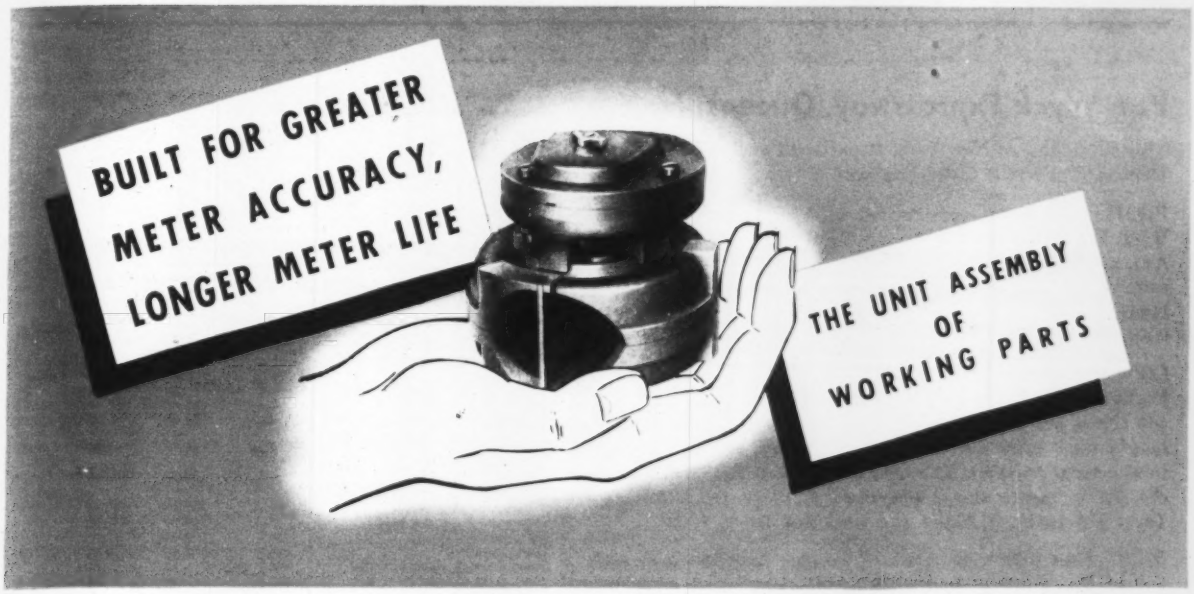
USES OF TRAFFIC ACCIDENT RECORDS—By National Conference on Uniform Traffic Accident Statistics. 187 pp. Eno Foundation for Highway Traffic Control, Saugatuck, Conn. Limited free distribution.

TIMBER ENGINEERS' HANDBOOK—Edited by Howard J. Hansen. 882 pp. John Wiley & Sons, New York 16, Chapman & Hall, London. $10.

HISTORY OF THE IMPROVEMENT OF THE LOWER MISSISSIPPI RIVER FOR FLOOD CONTROL AND NAVIGATION: 1932-1939—By Brig. Gen. H. B. Ferguson. 198 pp. Published in 1940 by the Mississippi River Commission and now out of print.

(*Continued on page* 142)

Here's a FISTFUL of Precision



You're looking at the "packed-with-performance" heart of a ⅝ in. size Pittsburgh disc meter. It's the precision made, precisely fitted measuring chamber and enclosed gear train assembly.

The care with which these measurement engineered parts are made means greater revenue and lower maintenance for you. For precision in meter manufacture directly affects accuracy in measurement, durability in service.

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UNIT PRICES BID BY CONTRACTORS

Van Wyck Expressway, Queens, N. Y.

OWNER: State of New York, Department of Public Works; Thomas F. Farrell, Chief Engineer.

PROJECT: Partial construction of a portion of the Van Wyck Expressway, Queens County, New York, between 105 Ave. and 115 Ave. Work includes construction of a trunk sewer, and 0.82 miles of grading and paving of service roads. Demolition of certain buildings remaining within contract limits is necessary.

CONDITIONS: All materials to be furnished by contractor. Project to be completed by September 1, 1948. Access to job site is available by rail, highway and water. Minimum hourly wage rates are: bulldozer operators, $2.12½; structural cement finishers, $2.50; structural iron and steel workers, $2.75; power shovel operators, $2.87½; truck drivers (over 1½ tons), $1.63½; and unskilled labor, $1.50.

BIDS: Four bids were received, ranging from the contract low of $1,320,529.50 to $1,422,275.00. Engineer's estimate was $1,445,000.00. Contract was awarded December 17, 1947.

LIST OF BIDDERS:

1. Tully and DeNapoli, Inc., Long Island City, N. Y. (contract) — $1,320,529.50
2. Hendrickson Bros., Inc., Valley Stream, N. Y. — 1,348,649.69
3. Gull Contr. Co., Inc. and L. G. DeFelice and Son, Inc., Flushing, N. Y. — 1,373,301.75
4. Rusciano and Sons, Inc., and DelBaso Const. Corp., New York, N. Y. — 1,422,275.00

	Item	Quantity	Unit Prices (1)	(2)	(3)
1	Clearing & grubbing	lump sum	$13,000.00	$13,125.00	$10,500.00
2	Unclass. excavation	322,000 cy	.67	.80	.75
3	Trench culv. & br. excav.	16,000 cy	1.75	1.50	1.40
4	Trimming shoulders & slopes	lump sum	13,000.00	12,200.00	7,500.00
5	Preparing fine grade	31,000 sy	.22	.12	.25
6	Vit. sewer pipe—6"	1,100 lf	3.00	1.20	2.50
7	Vit. sewer pipe—8"	1,200 lf	1.20	3.00	2.75
8	Vit. sewer pipe—10"	1,000 lf	1.65	3.00	3.25
9	Vit. sewer pipe—12"	3,250 lf	2.10	4.00	3.75
10	Vit. sewer pipe—15"	110 lf	3.10	5.00	4.50
11	Vit. sewer pipe—21"	190 lf	5.50	6.00	6.50
12	Vit. sewer pipe—24"	575 lf	17.00	7.00	10.50
13	Cast iron pipe—6"	500 lf	2.60	5.00	2.50
14	Cast iron pipe—12"	70 lf	6.00	10.00	6.00
15	Spec. RC pipe—15"	770 lf	3.60	4.00	5.50
16	Spec. RC pipe—18"	40 lf	5.00	4.00	6.75
17	Spec. RC pipe—24"	250 lf	8.00	6.00	8.75
18	Spec. RC pipe—30"	275 lf	11.00	8.00	10.00
19	Spec. RC pipe—66"	110 lf	32.00	30.00	27.00
20	Portland cement	11,200 bbl	3.00	3.25	3.25
21	Natural cement	800 bbl	4.00	4.00	3.50
22	Spec. portland cement	100 bbl	4.50	5.00	4.00
23	First class concrete	800 cy	29.00	40.00	30.00
24	Bar reinf. for structures	16,000 lb	.15	.12	.12
25	Misc. iron & steel	182,500 lb	.14	.15	.15
26	Bottom crse. broken stone	170 cy	8.00	10.00	7.00
27	Top crse. bit. mac. mix method optional	250 ton	11.00	14.00	9.00
28	Membrane waterproofing with p. c.	450 sy	7.50	4.50	4.00
29	Maint. traf. for bit. mac.	10,000 lf	.25	.50	.50
30	Protect traffic	lump sum	6,000.00	6,250.00	5,000.00
31	Temp. sheet. & brace (wood)	112,000 sf	.65	.20	.30
32	Perm. sheet. & brace	5 Mf bm	250.00	200.00	200.00
33	Screened gravel, loose measure	120 cy	7.00	7.00	5.00
34	Granite curb	730 lf	5.00	7.50	6.00
35	Reset old curb	100 lf	2.50	5.00	3.00
36	Conc. curb, type AS	16,300 lf	1.30	1.50	1.15
37	Manholes, type A	2 ea	700.00	500.00	225.00
38	Drop inlets, type C	18 ea	460.00	300.00	300.00
39	Drop inlets, type D	3 ea	460.00	300.00	225.00
40	Drop inlets, type QA	57 ea	275.00	300.00	200.00
41	Drop inlets, type QB	10 ea	85.00	200.00	150.00
42	Regular manhole, type QCS	10 ea	230.00	300.00	180.00
43	Regular manhole, type QC10	7 ea	240.00	300.00	175.00
44	Regular manhole, type QC12	6 ea	260.00	300.00	175.00
45	Shallow manhole, type QD12	5 ea	320.00	300.00	160.00
46	Shallow manhole, type QD15	1 ea	330.00	300.00	185.00
47	Shallow manhole, type QD21	3 ea	360.00	300.00	225.00
48	Shallow manhole, type QF30	1 ea	360.00	300.00	275.00
49	Std. drop pipe manhole, type QH15	1 ea	1,300.00	1,100.00	500.00
50	Std. drop pipe manhole, type QH24	1 ea	1,900.00	1,100.00	500.00
51	Std. drop pipe manhole, type QH30	1 ea	1,750.00	1,100.00	500.00
52	Std. drop pipe manhole, type QK66	2 ea	1,350.00	750.00	500.00
53	Spec. manhole, type QL	2 ea	375.00	400.00	250.00
54	Change elev. of manholes & catch basins	45 ea	50.00	50.00	40.00
55	Salvaging & resetting exist. castings	10 ea	40.00	50.00	20.00
56	Concrete sidewalk	7,500 sy	2.75	3.50	3.50
57	Timber & lumber	25 Mf bm	280.00	210.00	250.00
58	Spread top soil	1,500 cy	1.60	3.00	2.50
59	Demolition	lump sum	11,000.00	10,000.00	8,000.00
60	Sheet asph. pavement	30,000 sy	2.75	4.00	3.50
61	Stone block surface	120 sy	5.00	5.00	6.00
62	Granite header	660 lf	2.25	4.00	4.00
63	Timber curbing	1,100 lf	.75	1.00	1.00
64	Cinders, loose measure	100 cy	5.00	4.00	4.00
65	Timber guide rail, type B	750 lf	9.00	3.00	6.25
66	Conc. fdn. for dead end warn. light	10 ea	175.00	75.00	150.00
67	Traff. light conduit inst. in exist. light post	1 ea	40.00	45.00	150.00
68	Steel pipe conduit—2"	1,200 lf	2.50	2.30	2.50
69	Police tel. pull box 2'9" x 2'9" x 3'6"	3 ea	300.00	230.00	450.00
70	Temporary light poles	5 ea	175.00	330.00	330.00
71	Temporary overhead wire	1,000 lf	.50	.23	.30
72	Temporary barricades lighting	7 ea	450.00	72.00	725.00
73	Unit change of barricade lighting	7 ea	25.00	5.00	20.00
74	Temporary lighting of roadway warn. signs	6 ea	230.00	35.00	400.00
75	Furn. & install. lamppost type M & luminaire	19 ea	570.00	339.00	550.00
76	Furn. & install. lamppost type G & luminaire	52 ea	550.00	300.00	450.00
77	Concrete sidewalk box type I	5 ea	230.00	230.00	25.00
78	Steel conduit—1¼"	150 lf	3.50	3.00	2.75
79	Steel conduit—2"	530 lf	2.50	3.00	3.85
80	Furn. & install. conduit #6 bare	630 lf	.25	.25	.25
81	Furn. & install. conduit #6 RCL	1,300 lf	.60	.45	.40
82	Astronomical time switches	66 ea	60.00	35.00	50.00
83	Reinf. conc. trunk sewer 6'6" x 8'0"	2,567 lf	112.00	115.00	138.75
84	Reinf. conc. trunk sewer 6'6" dia.	1,450 lf	82.00	64.00	90.00
85	Chamber on trunk sewer at 115th Ave.	1 ea	5,000.00	3,500.00	4,000.00
86	Chamber on trunk sewer near 109th Ave.	1 ea	1,600.00	2,500.00	2,000.00
87	Chamber on trunk sewer at 109th Ave.	1 ea	2,200.00	2,000.00	2,000.00
88	Chamber on trunk sewer at 107th Ave.	1 ea	3,000.00	2,500.00	2,500.00
89	Manholes & drop pipe manholes	18 ea	650.00	400.00	300.00
90	Perm. sheet & brace	10 Mf bm	250.00	200.00	200.00
91	Vit. sewer pipe (sanitary)—8"	360 lf	32.00	10.00	10.00
92	Vit. sewer pipe (sanitary)—10"	1,510 lf	24.00	12.00	12.00
93	Vit. sewer pipe (storm)—12"	3,880 lf	4.00	12.00	8.00
94	Vit. sewer pipe (storm)—15"	1,430 lf	5.50	13.00	11.00
95	Vit. sewer pipe (storm)—18"	1,590 lf	6.50	16.00	10.00
96	Vit. sewer pipe (storm)—24"	85 lf	9.00	18.00	20.00
97	Spec. RV pipe (storm)—30"	125 lf	63.00	20.00	25.00
98	Manholes, type QR8	3 ea	320.00	500.00	250.00
99	Manholes, type QR10	10 ea	330.00	500.00	300.00
100	Manholes, type QS12	28 ea	320.00	400.00	250.00
101	Manholes, type QS15	10 ea	380.00	400.00	300.00
102	Manholes, type QS18	11 ea	350.00	400.00	300.00
103	Manholes, type QS24	1 ea	370.00	400.00	300.00
104	Manholes, type QS30	1 ea	500.00	500.00	400.00
105	Manholes, type QT18	1 ea	1,000.00	800.00	800.00
106	Spurs on sanitary sewers	50 ea	10.00	9.50	6.00
107	Spurs on storm sewers	190 ea	10.00	9.50	6.00
108	House conn. on sanitary sewer	130 lf	15.00	3.50	10.00
109	House conn. on storm sewer	250 lf	10.00	3.50	10.00
110	Wooden signs	4 ea	250.00	100.00	200.00
111	Permanent barricade	1,100 lf	5.50	4.00	3.50
112	Maint. traff. at st. crossings	lump sum	2,500.00	10,342.19	5,000.00

Viaduct Substructure, Chicago, Ill.

OWNER: Department of Public Works, Chicago, Ill., W. W. DeBerard, city engineer.

PROJECT: Construction of a viaduct substructure, 214 ft. long, on N. State St. from Kinzie St. to Chicago River. Viaduct has reinforced concrete deck and measures 66 ft. in width. Work includes installation of barricades and signs, removal of rock, boulders, masonry and other obstructions and the construction of sub piers.

CONDITIONS: Two lines of cassons or wells adjacent to a subway tube and a shaft and tunnel of the Illinois Bell Telephone Co. require particular consideration to prevent damage. All materials are to be furnished by contractor. Access to job site is available by rail, highway, and water. Stipulated contract time is six months after date of notification. The common labor wage rate is $1.50 per hr.

Continued on page 101

Viaduct Substructure, Chicago, Ill.

Continued from page 98

BIDS: Four bids were received, ranging from the contract low of $188,650.00 to $333,150.00. Contract was awarded November 13, 1947.

LIST OF BIDDERS:

1. Thomas McQueen Co., Forest Park, Ill. (contract) $188,650.00
2. M. J. Boyle & Co., Chicago, Ill. 217,012.50
3. Kenny Const. Co., Chicago, Ill. 218,055.00
4. Great Lakes Dredge & Dock Co., Chicago, Ill. 333,150.00

	Item	Quantity	Unit Prices (1)	(2)	(3)
1	Barricades and signs	lump sum	$500.00	$500.00	$200.00
2	Removal of obstructions	lump sum	1,500.00	500.00	1,000.00
3	Removal of rock, boulders, masonry	425 cy	6.00	2.50	44.00
4	Standard portland cement	2,700 bbls	3.50	4.50	3.55
5	Sub piers (excl. of cement & steel)	38,000 cf	3.05	3.85	3.68
6	Borings beneath sub piers	100 lf	15.00	5.00	3.00
7	Struct. carbon steel for sub piers	lump sum	3,000.00	600.00	1,500.00
8	Reinf. metal for sub piers	180,000 lb	0.09	0.08	0.10
9	Abutment complete	lump sum	32,000.00	36,750.00	24,000.00
10	Sand filling	100 cy	3.50	4.00	3.25
11	Yellow pine or douglas fir—untreated	6,000 bf	300.00	150.00	240.00
12	Pre-heat—extra mix. of concrete	200 cy	1.50	1.00	1.10
13	Cover & heat concrete in place	200 cy	2.00	1.00	1.60
14	High-early-strength portland cement	250 bbl	4.00	5.00	4.10
15	Mechanics' time per hour	200 hr	6.00	4.00	4.50
16	Laborers' time per hour	200 hr	5.00	2.50	3.50

Highway Improvements, White Pine County, Nevada

OWNER: State Department of Highways, Carson City, Nevada; W. T. Holcomb, engineer.

PROJECT: Grading and surfacing of 15.208 miles of highway on Routes 2 and 24, Sections E 2 and A, B in White Pine County, from Magnuson's Ranch to a point 15 miles North. Work includes roadway, drainage and structure excavation and the installation of 4,180 lin. ft. of corrugated metal pipe.

CONDITIONS: All materials to be furnished by contractor. Access to job site is available by both rail and highway. Stipulated contract time is 200 days. Prevailing skilled labor wage rate is $1.50 per hr.; semi-skilled, $1.40 per hr.; and common, $1.30 per hr.

BIDS: Eight bids were received, ranging from the contract low of $250,570.00 to $308,352.85. Contract was awarded November 7, 1947.

LIST OF BIDDERS:

1. Silver State Const. Co., Fallon, Nevada (contract) $250,570.00
2. Hoops Const. Co., Twin Falls, Idaho 256,377.85
3. Dodge Const., Inc., Fallon, Nevada 279,493.80
4. Carl E. Nelson Co., Logan, Utah 279,775.30
5. Hunt & Frandsen, Reno, Nevada 280,576.20
6. J. M. Sumsion, Springville, Utah 301,391.65
7. Isbell Const. Co., Reno, Nevada 301,955.40
8. W. W. Clyde & Co., Springville, Utah 308,352.85

	Item	Quantity	Unit Prices (1)	(2)	(3)
1	Signs	lump sum	$500.00	$600.00	$750.00
2	Roadway excavation	160,020 cy	0.22	0.25	0.29
3	Drainage excavation	1,240 cy	0.50	0.50	0.50
4	V-Type ditches	1,008 sta	4.00	4.00	5.00
5	Overhaul	378,100 sta y	0.02	0.01	0.015
6	Overhaul	7,940 mi y	0.20	0.20	0.15
7	Structure excavation	990 cy	2.00	1.00	1.50
8	Backfill	1,760 cy	1.00	1.25	1.50
9	Water	10,665 M gal	1.00	1.25	1.50
10	Power roller	607 hr	6.00	6.00	5.00
11	Tamping roller	10,490 f hr	0.50	0.60	0.50
12	Type 1 gravel base	11,490 ton	0.35	0.50	0.50
13	Gravel surface	93,790 ton	0.64	0.65	0.75
14	Liquid asphalt, type MC-2(seal roadmix)	164 ton	35.00	31.00	30.00
15	Liquid asph. type SC-2 or SC-3 (roadmix)	2,287 ton	28.00	29.00	29.00
16	Roadmix (32-foot width)	15.21 mi	900.00	900.00	1,000.00
17	Roadmix (22-foot width) (temporary connection)	1.15 mi	700.00	600.00	600.00
18	Roadmix intersections	370 sy	0.25	0.50	0.10
19	Class A concrete	198 cy	55.00	45.00	50.00
20	Reinforcing steel	10,980 lb	0.10	0.12	0.15
21	Corrugated metal pipe—15"	40 lf	3.00	3.00	2.50
22	Corrugated metal pipe—18"	1,868 lf	3.50	3.00	3.00
23	Corrugated metal pipe—24"	554 lf	5.00	4.50	4.25
24	Corrugated metal pipe—30"	158 lf	6.00	6.00	5.25
25	Corrugated metal pipe—36"	60 lf	9.00	8.00	7.50
26	Corrugated metal arch pipe—22"x13"	1,348 lf	3.00	3.25	3.50
27	Corrugated metal arch pipe—29"x18"	46 lf	5.00	5.00	4.75
28	Corrugated metal arch pipe—43"x27"	106 lf	9.00	8.00	8.00
29	Culvert markers	178 ea	5.00	6.00	6.00
30	Guide posts	27 ea	5.00	6.00	6.00
31	Monuments	41 ea	5.00	6.00	6.00

Well Pump Station, Newtown, Conn.

OWNER: State of Connecticut, Office of the Comptroller, Hartford; Henry Souther Engrg. Co., engineers.

PROJECT: Construction of two well pump stations and pipe line at the Fairfield State Hospital, Newtown, Connecticut. Work includes installation of two 700 gpm. turbine pumps, 3 sump pumps, 4,225 lin. ft. of 10 in. cast iron pipe, and construction of a service road, 3,510 lin. ft. long and a 20 ft. span bridge.

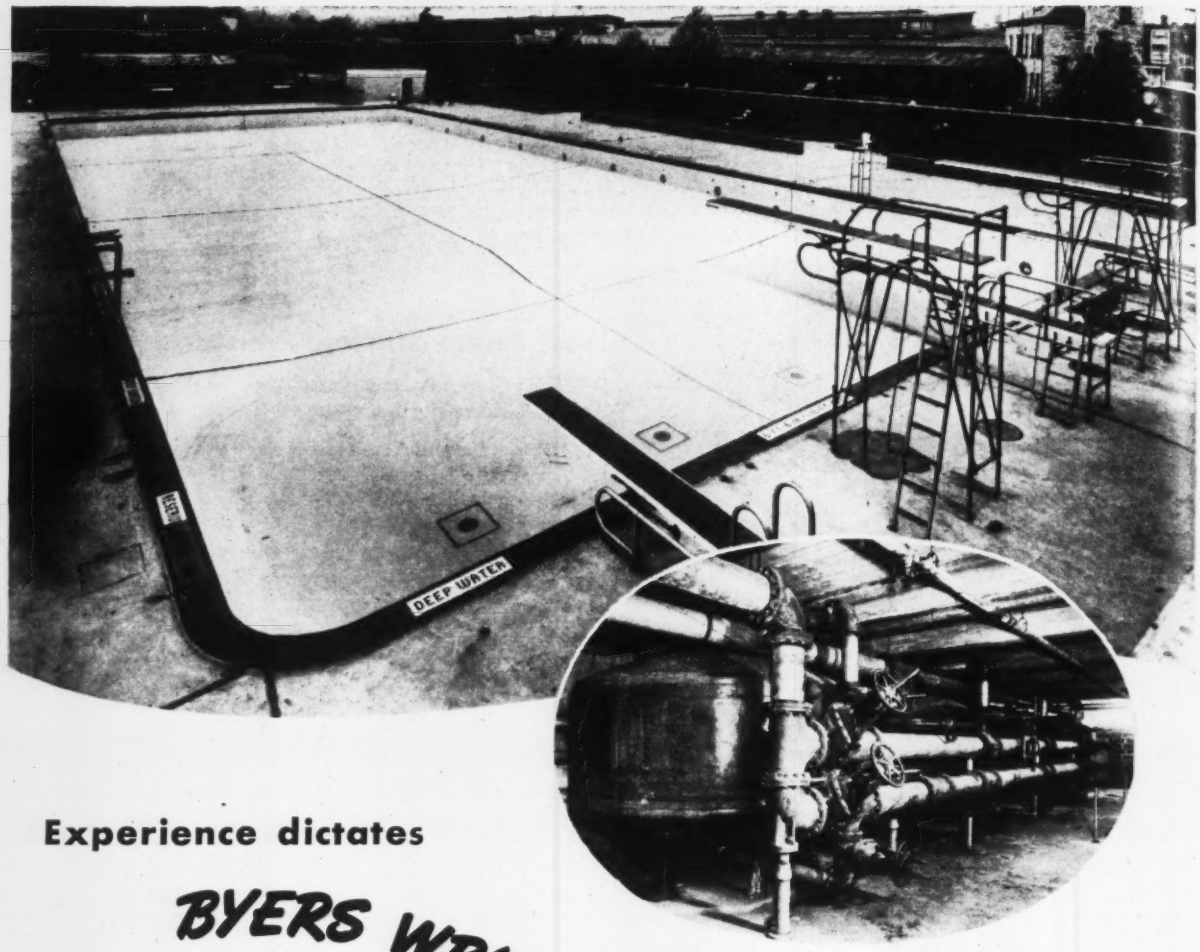
CONDITIONS: The supplementary unit prices tabulated below were submitted to show the changes in the amount of earth, trench, rock and bridge excavation due to special conditions found at site. Access to job site is available by both rail and highway. All materials are to be furnished by contractor. Project to be completed by May 1, 1948. Stipulated minimum skilled labor wage rates per hr. are: carpenters, $1.50; masons, $1.87½; engineers, $2.00. Semi-skilled labor wage rate ranges from $1.25 to $1.50 per hr. and common labor, from $1.00 to $1.25 per hr. Contract was awarded November 1, 1947.

BIDS: Four bids were received, ranging from the contract low of $98,850.00 to $121,294.50. Contract was awarded November 1, 1947.

LIST OF BIDDERS:

1. Seminole Const. Co., East Hartford, Conn. (contract) $98,850.00
2. N. Benvenuti, New London, Conn. 104,700.00
3. Charter Oak Const. Co., Hartford, Conn. 106,530.00
4. De Fonce Const. Co., Bridgeport, Conn. 121,294.50

	Item	Quantity	Unit Prices (1)	(2)	(3)
1	Constructing two pumping stations complete except pumps, piping and electrical work	lump sum	$8,200.00	$8,800.00	$8,000.00
2	Turbine pumps—700 gpm	2 ea	1,500.00	3,400.00	1,600.00
3	Sump pumps	3 ea	100.00		100.00
4	Trench excavation & backfill—6' depth and less	3,180 cy	2.50	2.40	1.00
5	Trench excavation & backfill—greater than 6' depth	550 cy	4.00	4.00	4.80
6	Rock	10 cy	10.00	12.00	15.00
7	Pipe lines, valves, fittings, and piping in pumping stations	lump sum	26,000.00	22,500.00	29,000.00
8	Electric wiring & distributions systems, & electrical equipment	lump sum	36,000.00	45,200.00	44,500.00
9	Service road—clearing, grubbing, preparing subgrade and ditches	3,510 lf	2.00	1.50	2.00
10	Road gravel	1,920 cy	1.50	1.25	2.00
11	Culverts	lump sum	2,500.00	1,000.00	1,200.00
12	Bridge	lump sum	2,700.00	4,500.00	3,500.00
	Supplementary Unit Prices				
13	General earth excavation		1.00	1.25	1.00
14	Trench excavation to 6' depth		2.50	1.50	1.00
15	Trench excavation over 6' depth		4.00	2.50	4.80
16	Bridge excavation		3.00	10.00	10.00
17	Rock excavation		10.00	12.00	15.00
18	Class A concrete including forms		60.00	35.00	45.00
19	Class B concrete including forms		50.00	30.00	42.00
20	Class B concrete without forms		20.00	20.00	25.00
21	Reinforcing steel in place		.20	.10	.20
22	Selected fill		1.00	1.00	2.00
23	Road gravel		1.50	1.25	2.00
24	Tile drains, 6", including excavation & backfill		3.00	1.50	3.00
25	Tile drains, 4", including excavation & backfill		2.50	1.40	2.50
26	Cast iron B & S pipe, 10", Class 150		5.00	4.00	6.10
27	1 Conductor # 1/0 power cable		.....	.496	.62
28	1 Conductor # 2 power cable		.....	.385	.56
29	7 Conductor # 12 control cable		.....	.523	.57
30	Fibre conduit, 3", fed. spec. WC 581 Type I		.....	.186	.46
31	Fibre conduit, 3", fed. spec. WC 581 Type II		.....	.186	.46
32	Cable manholes		200.00	225.00	250.00



Experience dictates

BYERS WROUGHT IRON PIPE

for pools like this

This fine new swimming pool, 75 ft. x 175 ft., was recently completed for the Cincinnati (Ohio) Arena Company. Frederick W. Garber handled the architectural details, while the swimming pool basin and the mechanical parts of the project were under the direction of Wayne A. Becker, an engineer who has specialized for years in pool design. Because of his long experience, the piping specifications are significant: both the 8-inch supply lines, and the 10-inch filter assembly piping, are wrought iron.

Confidence in the corrosion resistance of wrought iron in the presence at times of highly chlorinated water dictated this choice.

MANY SECTIONS . . . MANY SERVICES

Pool designers in all sections of the country share this preference for wrought iron, as the records show. The material has been installed in warm and cold salt and fresh water supply lines; return or re-circulating lines from pools to filters; scum-gutter drains or overflow lines; vacuum type cleaning-system piping; filter-wash lines; soil, waste, vent, and leader lines; underground gas lines; and electrical cable conduit. This, incidentally, provides a handy check-chart for anyone specifying piping for *proven* corrosion-resistance.

WHY WROUGHT IRON LASTS

Wrought iron's excellent performance comes from its unique structure and composition. Tiny fibers of glass-like silicate slag, threaded through the body of high-purity iron, halt and "detour" corrosive attack, and discourage pitting. The fibers also anchor the initial protective scale, which shields the underlying metal.

If you would like detailed information on any application, just get in touch with the nearest district office, or write to headquarters in Pittsburgh.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco. Export Division: New York, N.Y.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS

GENUINE WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

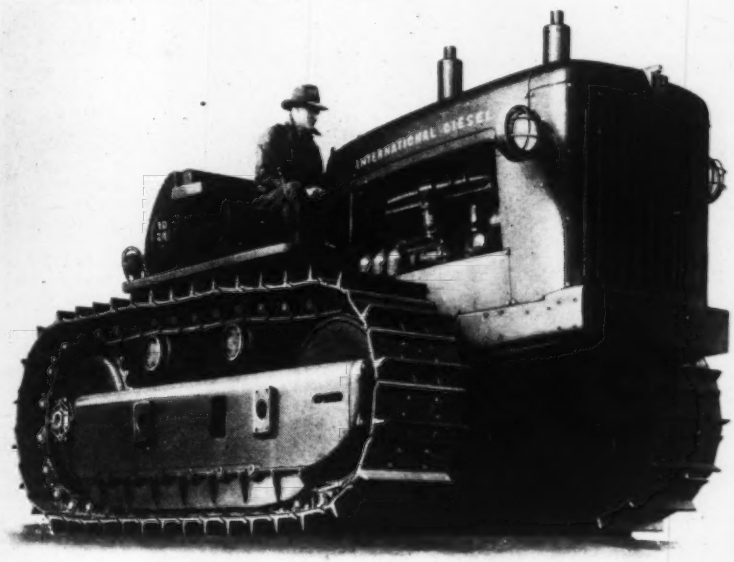
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

New Aids to the Constructor

MANUFACTURERS' LATEST DEVELOPMENTS IN EQUIPMENT AND MATERIALS

(Number refers to item directly below it)

133



POWERFUL CRAWLER TRACTOR—This new crawler is 182¼ in. long, 102 in. wide and 88 in. high to top of radiator. With the 6-roller track, as regularly equipped, it has 101⅜ in. of track length on the ground, providing 4,460 sq.in. of ground contact and 1,513 sq.in. of bracing grouser area with the regular 22-in. shoes. With water, fuel, and lubricants it weighs more than 38,000 lb. It has 180 hp. at the flywheel, 167 belt hp. and 140 drawbar hp. It has planet-power steering under finger-tip control with new hydraulic system. This permits gradual turns with both track pulling or pivot turns with one track locked and the other under full power. Pilot models have been tested under all service conditions for more than two years. This is the International TD-24—*Industrial Power Division, International Harvester Co., Melrose Park Works, Chicago, Ill.*

134

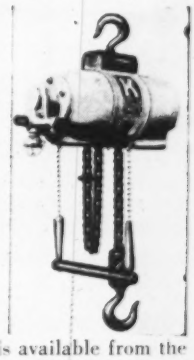
BRAKE LINING—Designed for service duty trucks and known as PGT sets, new brake linings will be factory-matched from seven different friction materials to meet individual needs of various makes of trucks and offer full-range brake control.—*Raybestos Division, Raybestos-Manhattan, Inc., Bridgeport, Conn.*

135

SELF-ALIGNING IDLERS—Two improved self-aligning idlers for belt conveyor service are positive-type idler (above) with guide rollers and (below) idler with flared, friction-type end pulleys particularly adaptable for reversible belts. They are described in 160-p. catalog.—*Jeffrey Mfg. Co., Columbus 16, Ohio.*

136

ONE-TON AIR HOIST—Air hoist has variable speeds from "creep" to 17 ft. per min. Standard length of lift is 8 ft. Hoist weighs only 75 lb. and has lifting capacity of 1 ton. Power is furnished by special vertical piston type air motor. Safety features include safety stops, high grade alloy steel roller chains, drop forged swivel hooks. Full descriptive literature is available from the manufacturer.—*Keller Tool Co., Grand Haven, Mich.*

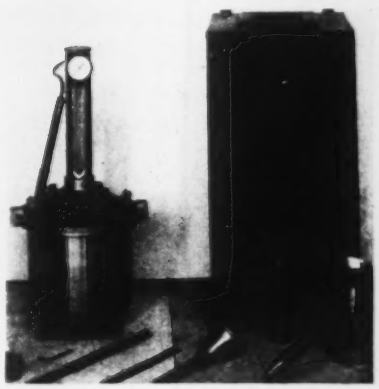


137

HEAVY DUTY GRIZZLY — This heavy duty electric vibratory grizzly feeder is available in different sizes and styles, either single or double magnet, with the magnets mounted above or below the deck, all featuring the variable control of the rate of feed and with either full or partial grizzly decks.—*Syntron Co., 328 Lexington, Homer City, Pa.*

138

ENTRAINED AIR INDICATOR—This indicator of 0.44 cu. ft. capacity, operates by the pressure method. A sample of fresh concrete is placed in the bowl, the conical cover is clamped in place and filled with water, pressure is applied and the entrained air in the concrete is compressed in accordance with Boyle's law. Air content of the sample is read directly. The manufacturer gives information concerning the procedure for determining entrained air in fresh concrete and also for the determination of the aggregate correction factor; as well as for the expansion factor for the indicator, which is calibrated to determine operating pressure.—*Robert Tarrant Mfgr. Co., 325 West Illinois St., Chicago, Ill.*



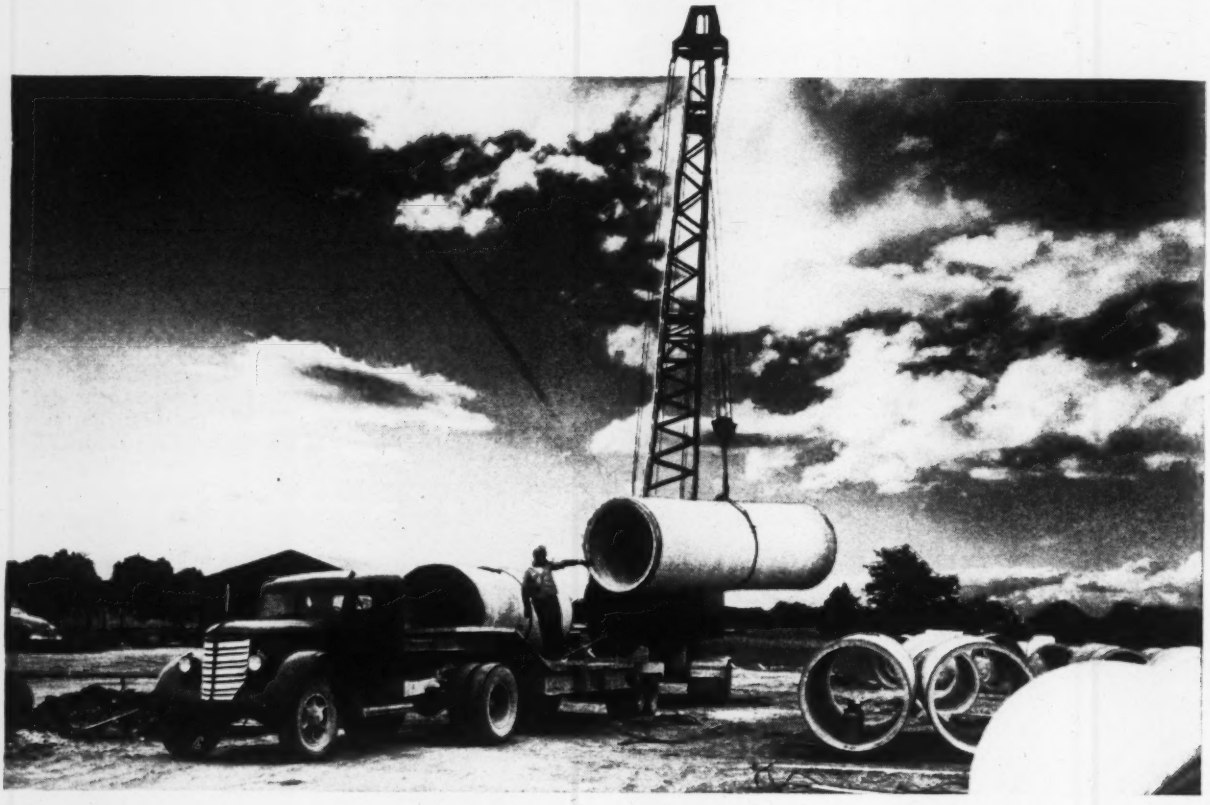
139

PLASTIC COATING—Plastiglaze, transparent air dry coating, serves as impregnating hardener for porous materials such as plaster, paper products or composition board. It has been successfully used to waterproof and toughen plywood forms for concrete.—*Calresin Corp., 8564 Washington Blvd., Culver City, Calif.*

Gulf Quality Lubricants and Fuels

help maintain rapid pipe delivery service

on **78-mile water line**



Lock Joint Pipe Company has the contract to provide 48-inch, 36-inch, and 24-inch reinforced pre-stressed concrete cylinder pipe for the 78-mile water pipeline now being constructed in northern Michigan. This is an $11,500,000 project. The 48-inch line will convey water from Lake Huron at Whitestone Point to the 36-inch and 24-inch branch lines that will deliver it to the city of Saginaw, Michigan.

"TO KEEP AHEAD of the laying contractors on this rush job, we have to keep our trucks moving fast—and we can't take chances on breakdowns," says the Lock Joint Pipe Company. "That's why we specify Gulf lubricants and fuels. These quality petroleum products keep our trucks continuously on the job, and we have rock-bottom maintenance costs."

On all types of construction projects, Gulf quality petroleum products play an important part in keeping equipment rolling. Their extra value shows up particularly on tough schedules and under punishing operating conditions. Gulf lubricants provide greater protection against delays caused by mechanical troubles — and Gulf fuels help contractors get an extra margin of performance from their mechanized equipment.

Write, wire, or phone your nearest Gulf office today and arrange to use Gulf higher quality lubricants and fuels on your next job. They are quickly available to you through 1200 warehouses located in 30 states from Maine to New Mexico.

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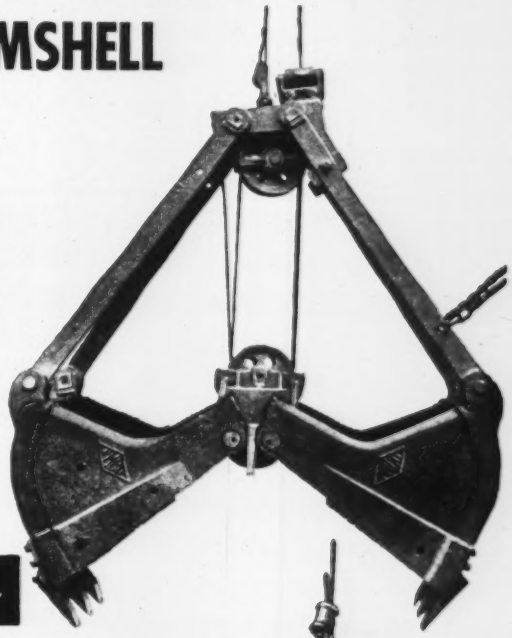
High Speed Cutting Tools for Expensive Machines

All Purpose SHOVEL
PULLSHOVEL • DRAGLINE
CLAMSHELL

FRONTS, BOTTOMS, SCOOPS and TEETH shown in yellow on buckets are 14% manganese steel developing tensile strength up to 120,000 p.s.i. This high percentage manganese steel gives tough, rugged strength for hard service and allows wide set corner teeth for easy entrance in digging. Volume production methods enable us to build a better bucket with amazing economies in manufacturing.

Experience Counts. **See your shovel man or equipment dealer about PMCO Buckets and Dippers.**

On the ½ yd. and ¾ yd. Shovel, Pullshovel and Dragline Buckets, all teeth are interchangeable—a great advantage to operators.



Clamshell
Sizes ⅜, ½, ⅝, ¾, 1 yd.

Pullshovel
Outside Cutter Widths:
21", 26", 31", 36", 39"

Shovel
Sizes ⅜ to 18 yds.

Dragline
Perforated Sizes ⅛ yd. to 2 yds.
20%-40% lighter than other makes
Solid sizes ⅜ yd. to 2 yds.
Mine Stripping Sizes 2yds. to 9 yds.

"Quality Since 1880"

PETTIBONE MULLIKEN CORP. CHICAGO 51, U. S. A.

WE OPERATE THE LARGEST AND MOST COMPLETE MANGANESE STEEL FOUNDRY IN THE UNITED STATES

On a pound-for-pound-basis ARMCO Tunnel Liner Plates are in a class by themselves. They save you money and speed the job.

These sturdy plates are designed for utmost strength with the least possible weight. One unskilled workman can carry, hold and bolt into place an ARMCO Liner Section. Only a structural wrench is needed. Labor costs are low and the job goes fast. Less bulk also means less excavation, and storage requirements are smaller. With ARMCO Plates you buy no excess metal, and this keeps job costs down.

Consider tunneling that next job with the aid of ARMCO Tunnel Liner Plates. You'll find it the simplest, most inexpensive way you ever saw to install conduits, sewers and similar structures. The hazards and inconvenience of open trenches are avoided and business above ground goes on as usual. Write for prices and complete information on your specific needs. Armco Drainage & Metal Products, Inc., 2045 Curtis Street, Middletown, Ohio.

EXPORT: THE ARMCO INTERNATIONAL CORPORATION

ARMCO

ARMCO TUNNEL LINER PLATES

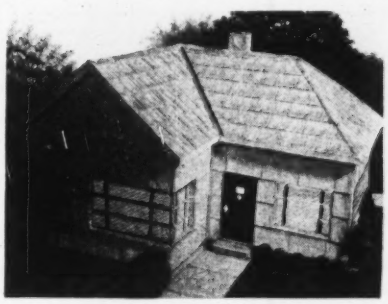
140

SMALL TRACTOR — This small rubber-tired tractor equipped with bulldozer blade for miscellaneous construction work is of welded steel with 7½ hp engine, weighs 885 lb., has wheelbase of 40 in., has automobile-like operation in steering and gear shift lever, can easily be backed into

corners and is claimed to operate all day on 2 gal. of gasoline. It is equipped with power takeoff and friction clutch which automatically disengages when engine speed drops below certain number of revolutions.—*National Iron Works, San Diego, Calif.*, for *Lincoln Tractor Co., Arcadia, Calif.*

141

ALUMINUM HOUSE — Illustrated is a model of a home with aluminum roof and siding, materials for which are to be produced by a newly-organized company. Production already has started on aluminum shingles which have four interlocking sides, an entirely new departure. They give the appearance of grained wood shingles, but have the advantage of permanency, fire



safety and insulation against temperature changes. They may be used over old roofs or in new construction and may be painted or left in natural color. The cost for the present will be from 10 to 15 percent higher than cedar or composition shingles, although the company hopes eventually to produce them on a competitive price basis. Shakes of same Aloca aluminum alloy will be produced later.—*Alumina-Lock Co., Portland, Ore.*

(*Continued on page* 114)

WK-80 Model 105 gasoline driven Joy Compressor is the perfect team-mate for Silver Streak Paving Breakers. Available in sizes 60 to 630 c.f.m.

Drill more footage in less time

Joy Wagon Drills, with their longer feeds and faster drilling speeds, will give you more footage per day—more economically.

Consult a Joy Engineer or write for detailed bulletin

SULLIVET CARBIDE TIPPED ROCK BITS increase drilling efficiency

Longer drill feeds in hard rock . . . increased drilling speed . . . fewer bit changes, less time lost . . . no hole taper; increased blasting efficiency.

FOUR POINT CROSS BIT

SULLIVAN DIVISION

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING • PITTSBURGH, 22 PA.

Worthington-Ransome Blue Brute Distributors

See ad on page 115 for list of equipment in each line

Worthington-Ransome Distributors

Ala., Birmingham, Ragsdale Mach. Co., Inc.
Alaska, Anchorage, Airport Mach. & Storage Co.
Ariz., Phoenix, Lee Redman Equipment Co.
Ark., Fort Smith, R. A. Young & Son
Little Rock, R. A. Young & Son

Calif., Richmond, Bay Equip. Co.
Cal., L. A. Golden State Equip. Co.
Colo., Denver, Power Equipment Co.
Conn., Wallingford, Wilhelm-Davies Co., Inc.

Fla., Miami, Allied Equip. Inc.
Orlando, Highway Equipment and Supply Co.
Tampa, Epperson & Company

Ga., Atlanta, Tractor & Machinery Company

Ida., Boise, Olson Manufacturing Co.
Ill., Chicago, Thomas Hoist Co.
Iowa, Cedar Rapids, McNall Mach. & Supply Corp.

Kansas, Topeka, M. B. Salisbury Co.
Ky., Harlan, Croushorn Equip. & Supply Co.
Louisville, Williams Tractor Co.

Maine, South Portland, N. A. Burkitt, Inc.
Mich., Muskegon, Lakeshore Machy. & Supply Co. Inc.
Mich., Detroit, W. H. Anderson Co., Inc.
Minn., Minneapolis, Phillippi Murphy Equip. Co.
Mass., Cambridge, Field Machy. Co.
Mass., West Springfield, E. F. Edson Co., Inc.
Miss., Jackson, Jackson Road Equip. Co.
Md., Baltimore, Paving Supply & Equip. Co.
Md., Salisbury, Paving Supply & Equip. Co.
Mo., Clayton, The Howard Corporation
Mo., Kansas City, Machinery & Supplies Co., Inc.
Montana, Billings, Interstate Truck & Equip. Co.
Helena, Caird Eng. Works
Montana, Missoula, Miller Machinery Co.

Nevada, Elko, C. W. Paul Hardware and Machy. Co.
N. Hampshire, Manchester, R. C. Hazelton Co., Inc.
N. J., No. Bergen, American Air Comp. Corp.
N. M., Albuquerque, Bud Fisher Co.
Roswell, Smith Machy. Co.
N. Y., Albany, Milton-Hale Machinery Co.
N. Y., Buffalo, Murray Equip. Co.
New York, Hodge & Hammond, Inc.
Syracuse, Milton-Hale Mach. Co.
N. C., High Point, Smith Equip. Co.
N. D., Fargo, Smith, Inc.

Ohio, Cincinnati, Carroll-Edwards & Co.
Dayton, Carroll-Edwards & Co.
Toledo, The Kilcorse Machy. Co.
Okla., Oklahoma City, Tattan-Douglas Equip. Co.
Oregon, Portland, Andrews Machinery

Pa., Bradford, Bradford Supply Co.
Wilkes-Barre, Ensminger & Co.
Mechanicsburg, American Equip. Corp.
Philadelphia, Metalweld, Inc.

S. C., Columbia, Smith Equipment Co.

Tenn., Chattanooga, Dempster Bros., Inc.
Tenn., Knoxville, Dempster Bros., Inc.
Memphis, Hamilton Tractor Co.
Nashville, Dempster Bros., Inc.
Tex., Amarillo, T. W. Carpenter Equip. Co.
Abilene, W. T. McClure Mach. Co.
Dallas, Shaw Equip. Co.
Houston, So. Texas Equip. Co., Inc.
San Antonio, Patten Machy. Co.

Utah, Salt Lake City, J. K. Wheeler Mach. Co.

Vt., Barre, A. M. Flanders, Inc.
Va., Richmond, Highway Machy. and Supply Co.
W. Va., South Charleston, Allied Equip. Co.
Wash., D. C., Paving Supply & Equip. Co.
Wash., Seattle, Star Machy. Co.
Wash., Spokane, Star Machy. Co.
Wash., Yakima, Star Machy. Co.
Wisc., Milwaukee, Drott Tractor Co., Inc.

Ransome Distributors

La., New Orleans, Ole K. Olson Co.

N. Y., Rochester, B-G Equip. Co.
O., Cleveland, H. B. Fuller Equip. Co.
Pa., Pittsburgh, Arrow Supply Company.

Worthington Distributors

Ind., Indianapolis, Reid-Holcomb Company

La., New Orleans, Wm. F. Surgi Equip. Co.

Md., Baltimore, D. C. Elphinstone, Inc.

O., Cleveland, Gibson-Stewart Co.
O., Columbus, Gibson-Stewart Co.

Pa., Allentown, H. N. Crowder, Jr., Inc.
Pittsburgh, Atlas Equip. Corp.

Texas, El Paso, Equip. Supply Co.

Wyoming, Cheyenne, Wilson Equip. & Supply Co.

Buy Blue Brutes

Worthington Pump and Machinery Corp.
Worthington-Ransome Construction Equipment Division
Holyoke, Massachusetts

142

PAVING FINISHER — This diagonal screed finishing machine is called a mass-production labor saver. It is equipped with a transverse front screed and a pivoted rear screed which the operator can swing diagonally in either direction to operate at whatever angle best suits the work. Gradual adjustments of the screed angle are made without stopping as the machine approaches and leaves super-elevated curves. Accuracy of surface results from the use of this machine from the fact that the rear screed, operating diagonally to the front one, always meets the material at a different point, removing high spots with a slicing action and troweling material into low spots. —*The Jaeger Machine Co., Columbus 16, Ohio.*

143

SELF-PROPELLED EARTHMOVER —Increased power in this new "Terra-Cobra" earthmover enables it to climb steeper grades and traverse soft mud, sticky clay and loose sand under heavily loaded conditions, with plenty of pull and minimum gear shifting. It has a larger clutch and heavier duty transmission. It has positive 2-wheel hydraulic steering control. It has four forward speeds up to 17 mph. fully loaded and one speed reverse. The scraper bowl has a heaped capacity of 17.5 cu. yd. and 14.0 yd. struck.—*Wooldridge Mfg. Co., Sunnyvale, Calif.*

144

WAGON DRILL—New wagon drill has 3-wheel Universal mounting with motor feed for 6-ft. steel changes. Motor feed is operated by powerful 5-cylinder radial air motor, driving chain attached to heavy mounting slide carrying drill. It carries 3½ or 4-in. bore derrick drill. Feed can be reversed instantly for effective churning. Drills have air-actuated exhaust control valve operated by drill throttle handle. U-bar is adjustable from position slightly above horizontal through arc of 90 deg. to one practically vertical.—*Gardner-Denver Co., Quincy, Ill.*

IF YOU WANT MORE INFORMATION on new products or manufacturers' publications, mark the identifying item numbers on the coupon below, and mail. No cost or obligation to you.

New Products Department, Engineering News-Record,
330 West 42nd St., N. Y. 18, N. Y.

Send me further information on items numbered _____ _____ _____

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Company _____

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Manufacturers' Publications

145

New Motor Trucks—A large packet of sheets and photos contains all the news of the new 1948 line of Ford motor trucks, the first new postwar products of the company. These trucks are notable for the large range of models and capacities and for many engineered changes.—*Ford Motor Co., Dearborn, Mich.*

146

For Concrete Floors—This booklet develops the proposition that aggregates must be carefully selected and prepared and that emery aggregate produces strong, hard, long-wearing concrete because it is a natural mined material, scientifically crushed, sized, cleaned and graded.—*Walter Maguire Co. Inc., 330 West 42nd St., New York 18, N. Y.*

147

Painting Guide — (40-page book) This book will help to insure the proper use of paint and related materials. On a double-page spread is given the method of painting walls, furniture, woodwork, floors, etc. It is thoroughly and uniquely indexed.—*Devoe & Raynolds Co., Inc., 44th St. & 1st Ave., New York 17, N. Y.*

148

Street Cleaner—An illustrated folder tells about a new machine that sweeps, sprinkles or flushes streets, cleans sewers, sprays trees and fights fires—a low cost multi-purpose unit designed for city and town use.—*Rosco Manufacturing Co., 3118 Snelling Ave., Minneapolis 6, Minn.*

149

Jaw Crushers — (12-page catalog) This publication develops the theme of lower cost per ton crushed and contains information on weights, dimensions and capacities. — *Lippmann Engineering Works, 4603 W. Mitchell St., Milwaukee 14, Wis.*

150

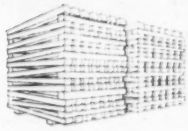
Wire Rope Sling — Bulletin tells about a flat-laced wire rope sling made of six parts of wire laced together to form a flat, strong and flexible lifting device.—*A. Leschen & Sons Rope Co., 5909 Kennerly Ave., St. Louis 12, Mo.*

TO HELP YOU MAP

Construction and Maintenance Savings . . .

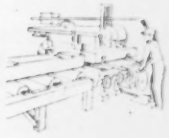
You get something *more* than rock-bottom first cost and rock-bottom maintenance when you use KOPPERS Pressure-treated wood; you're sure of a *convenient, accessible* source of supply.

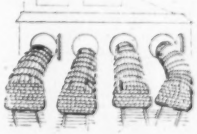
The twenty-one treating plants are spotted at strategic points throughout the area east of the Rockies. And here are the ways that the typical plant is geared to serve you . . .



EXTENSIVE STOCKING FACILITIES. Acres of area are provided for the storage and seasoning of cross ties, piles, posts, timber, and lumber. Many items are available from stock for *immediate* treatment and delivery.

MODERN FABRICATING EQUIPMENT. Wood working machinery installed in many plants fabricates structural parts to customers' blue-print, eliminating any framing or cutting on the job.





HIGH TREATING CAPACITY. Koppers treating facilities include cylinders which will accommodate pieces up to 125-feet in length. Modern instruments assure the control necessary for top quality and uniformity.

WANT MORE DETAILS? This book, "Economical and Permanent Construction with Pressure-Treated Wood" gives the whole story of the treatments available, and the applications where pressure-treated wood has proved its economy. Ask for a copy.

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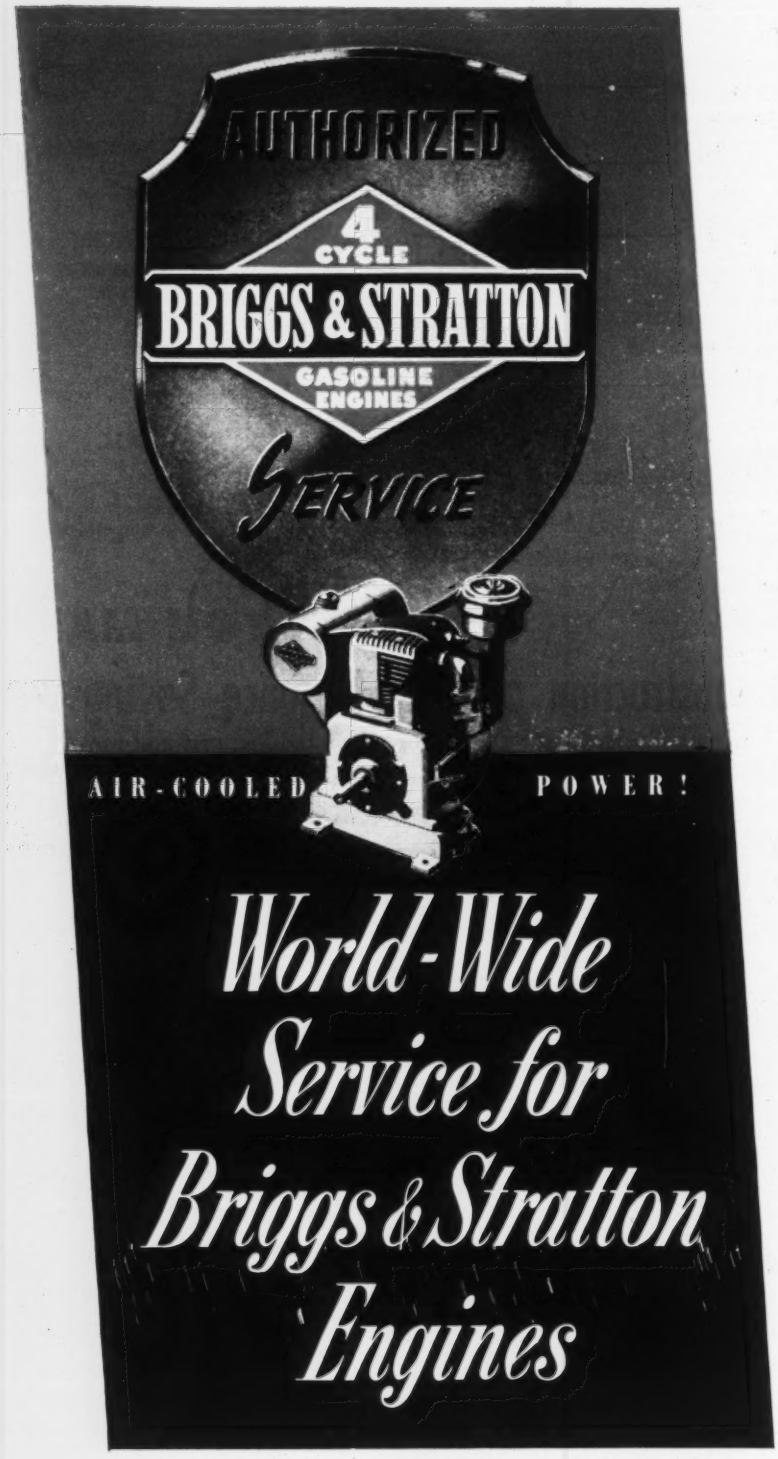
PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

PITTSBURGH 19, PENNSYLVANIA



In the United States, Canada, and throughout the world, Briggs & Stratton maintains a vast network of *Authorized Service Stations*, operating under factory supervision and policies.

These stations offer complete engine service — unequalled in the industry — mechanics, factory trained to adjust, repair, or rebuild Briggs & Stratton engines with original parts. One more reason why Briggs & Stratton is "preferred power" by manufacturers, dealers, and users of industrial equipment, farm machinery, and appliances.

BRIGGS & STRATTON CORP., MILWAUKEE 1, WIS., U.S.A.

151

Concrete Trucks—(Illustrated folder) Describes FWD trucks for mounting ready-mixed concrete bodies. — *Four Wheel Drive Auto Co., Clintonville, Wis.*

152

Wellpoint Systems—(72-p. catalog) Contains latest information and photos of wellpoint systems for dewatering emergency and permanent water supply systems. Photos and line drawings show typical layouts and case histories. —*Griffin Wellpoint Corp., 881 E. 141st St., New York 54, N. Y.*

153

Sand Filter — (12-p. bulletin) Describes automatic backwash rapid sand filter for purifying industrial water supplies, sewage treatment, trade waste recovery, municipal water treatment, and for raw water purification in paper mills.—*Hardinge Co., Inc., York, Pa.*

154

Thawers and Heaters—(16-p. booklet) Describes equipment for heating, thawing, melting ice and snow, and providing temporary heat in various applications.—*Hauck Mfg. Co., 124-136 Tenth St., Brooklyn 15, N. Y.*

155

Steel Sash—(32-p. catalog) Illustrates design and construction features of new Lok'd Bar steel factory sash giving dimensions and physical data in full-scale diagrams. Windows opening dimensions are tabulated.—*Hope's Windows, Inc., Jamestown, N. Y.*

156

Safety Equipment — (4-p. folder) Features Nitroflex aprons and sleeves, new line of protective apparel for industry. Work gloves, cradles for drums and barrels, chain grips, and door opener are also covered. — *Industrial Products Co., 2820 N. Fourth St., Philadelphia 33, Pa.*

157

Protecting Metal Surfaces — (12-page booklet) Describes a specialized protective coating material used on both new or uncoated metal structures and over previously coated surfaces. This coating is said to provide a tough but pliable and elastic weather-resistant, water repellent material that keeps out vapor, moisture, acid and alkali gases and fumes.—*The Arco Co., 7301 Bessemer Ave., Cleveland 4, Ohio. or 745 E. 59th St., Los Angeles, Calif.*

158

Aviation Lighting—A large indexed catalog covers beacons, marker lights, control desk and panels, floodlights, weather equipment, accessories and parts, etc. Of value to airport builders. —*Crouse-Hinds Co., Syracuse, N. Y.*

159

Arc Welder — Handy size booklet gives full information on multi-range arc welders and electrodes.—*Hobart Brothers Co., Troy, Ohio.*

160

Safety Treads—12-page catalog on safety treads for stairs and ramps in public and institutional buildings. Materials are white alloy and yellow brass, cast iron and aluminum. Other products described are elevator sills, thresholds, window sills, curb bars and trench covers.—*Wooster Products, Inc., Wooster, Ohio.*

161

Chemical coatings — Bulletin describes chemical resistant coatings which are fortified with rubber to resist chemical conditions that are the major cause of rust in many types of industrial plants.—*Rust-Oleum, 2425 Oakton St., Evanston, Ill.*

162

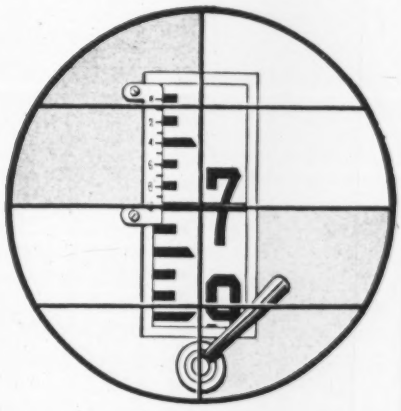
Metal Storm Window — (4-page folder) This tells about a metal storm window that combines with steel casement and screen to form a complete window unit. It is made of formed steel, bonderized, quickly and easily installed, and fits snugly against the casement on the inside.—*Detroit Steel Products Co., 2250 East Grand Boulevard, Detroit 11, Mich.*

163

Portable Cords and Cables—A 68-page, 2-color catalog offers complete information concerning portable cords and cables. Besides giving the usual weights and dimensions, the book describes the process of manufacture and also gives full data on splicing.—*Simplex Wire & Cable Co., 79 Sidney St., Cambridge 39, Mass.*

164

Service Elevators—Bulletin describes fast inter-floor transportation with a service elevator for a variety of industries. Can be used in any building up to 200 ft. high. Takes less space than stairway or regular elevator.—*Allis-Chalmers Mfg. Co. Milwaukee 1, Wis.*



When you're on target with a White ...you're absolutely right!

- You can be absolutely confident of precision results with White instruments. That's because every step in their manufacture is made with that thought in mind. For example, the metals used in making various parts are a special bronze, brass and nickel silver. Whenever advisable, individual parts are carefully heat-treated to remove all internal stress and strain.
- But that's only part of the story — all graduations on White instruments are guaranteed for accuracy — they're made by a special dividing engine in a totally enclosed heat-controlled, air-conditioned room. Graduating surfaces are grained Sterling Silver to reduce reflection to preserve accuracy.
- Finally — White instrument optics are coated — to transmit the brightest and sharpest possible image through the sighting telescope. Brightness is increased as much as 40 per cent because of increased light transmission — contrast is improved by reducing the haze caused by internal reflections.

Write today for detailed literature and price data.
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Illustrated, famous Type II Transit No. 7016. Telescope 11½" long — internal focusing — 24 power. Horizontal limb graduated to 15 minutes, Verniers to 20 seconds, 6½" diam.

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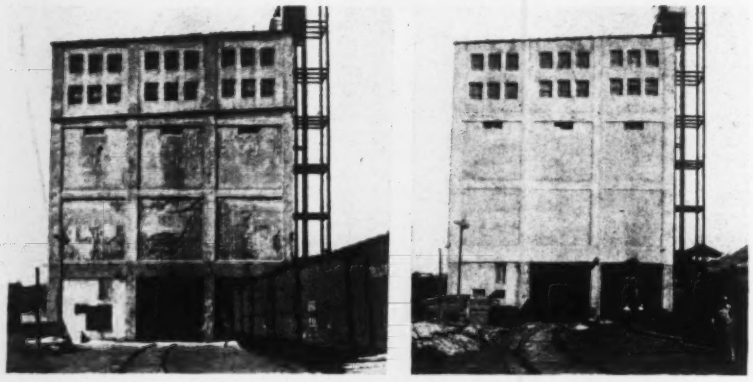


"GUNITE" RESTORES CONCRETE BUILDING

The before and after photos show the breaker building at Cayuga Rock Salt Company, Myers, N. Y. This concrete building was badly disintegrated due to salt action on the reinforcing steel. In 1946 we contracted the complete reintegration of the walls and roof of this building.

The disintegrated areas of the walls were chipped and the entire surface washed and sandblasted. Reinforcing mesh was placed over the entire area and 1½" minimum "GUNITE" applied, and brush finished. The roof slab was similarly repaired with "GUNITE," both top and bottom. Sufficient old concrete was chipped away to prevent increasing the dead load of the roof slab.

"GUNITE" is impervious, thus it will not permit the infiltration of salt brine to attack the reinforcement. Its use as armor against sea water and conditions such as above described is very common, and its success remarkable.

Write for our free 72-page descriptive bulletin A-2300.

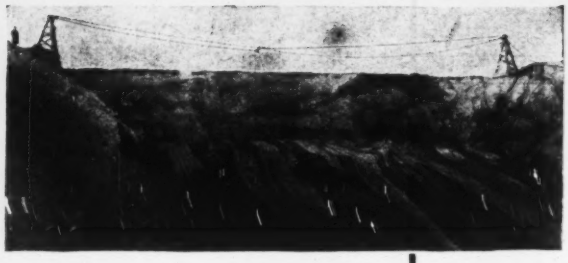
CEMENT GUN COMPANY

"GUNITE" CONTRACTORS

GENERAL OFFICES—ALLENTOWN, PENNA., U.S.A.

SAUERMAN

FOR FAST MATERIAL HANDLING AT LOWEST COST



Digging — Hauling — Dumping

. . . . operations are merged into one simple, continuous operation when you use SAUERMAN Long Range Machines. Flexible for a wide range of excavation and material handling or disposal, there is a correct type of SAUERMAN Machine to meet your exact problem. Excavates equally well under water. Requires *only one man* for operation. Electric, gasoline or Diesel power. Easy to install—low power consumption—simple upkeep.

Send us details and we will be glad to advise on your own project.

The SAUERMAN Scraper in the above picture is cutting into a hill and moving material to a fill 400 ft. away. The 4 cu. yd. machine digs and places 2,000 cu. yd. a day. Shifting of the path of the scraper is facilitated by means of an elevated tail bridle set up on the brow of the hill, from which a shifting cable runs to the front drum of the 3-drum scraper hoist.

Catalog on Request

SAUERMAN BROS., Inc.

532 S. Clinton St. Chicago 7, Ill.

Long Range Material Handling Machines

Men and Jobs

Paul E. Wicklund, assistant division engineer, Public Buildings Administration, New York, has been detailed to the State Department and will assume supervision of acquisition and construction activities in connection with U. S. embassies in Denmark, Finland, Norway and Sweden, working out of Copenhagen. After graduation from the college of engineering and architecture at the University of Minnesota, he was employed for eight years by Graham, Anderson, Probst and White, Chicago architects, and for the last 13 years by the Public Building Administration on design and construction of public buildings.

C. Lyle Carey, engineer of district No. 6, Nebraska State Highway Department, with the department 21 years, has resigned and has been succeeded by **D. O. Coolidge,** with the department 19 years.

E. Darrell Jervey, engineer for the Charleston County S. C., Sanitary and Drainage Commission since August, 1925, and an employee of the commission since 1917, has resigned effective July 1, 1948. He plans to practice engineering for himself. Julian B. Weston, who has been Mr. Jervey's assistant, is expected to succeed him.

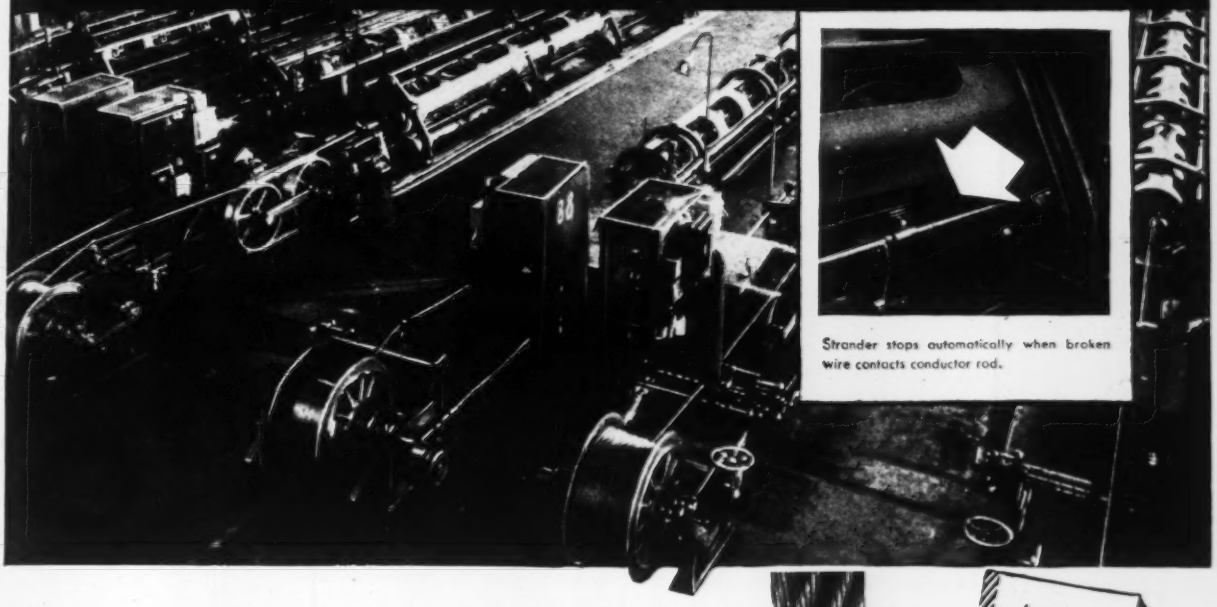
F. C. Wightman, city manager and engineer of Sackville, N. B., has resigned.

Resignation of **Earl D. Schwartz,** of Harrisburg, as senior bridge designer for the Pennsylvania Department of Highways, has been announced.

Fred Day, associate engineer of the Water Resources Division of the North Carolina State Department of Conservation and Development, is directing the installation of a steam measuring installation on the Neuse River near Goldsboro, N. C. It is a project of the Army Corps of Engineers with the U. S. Geological Survey and the department.

James J. Deneen, city engineer of Crookston, Minn., has been employed as city manager of Montevideo, Minn.,

Giants With Super-Sensitive Nerves



Strander stops automatically when broken wire contacts conductor rod.

Wickwire's modern rope machines (some of which twist as many as 46 wires into strand in a single operation) operate at tremendous speed. Yet, if a single wire breaks or if the wire in a spool runs out, the entire machine comes to a dead stop in less than six seconds.

When the sensitive automatic electric controls and air brakes have brought the strander to a stop, the wire ends are micro-welded by a skilled operator, who subsequently anneals the weld to restore its original toughness and ductility. Such thoroughness is your assurance of the uniformity and perfect construction, necessary if a rope is to deliver the utmost in performance, safety and long life.

Wickwire Distributors and Rope Engineers in key cities everywhere are ready to help solve your wire rope problems and to supply the type of rope that best meets your requirements. Wickwire Rope is available for prompt delivery from strategically located warehouse stocks and is supplied in all sizes and constructions, both regular lay and WISSCOLAY *Pre*formed.

HOW TO REDUCE ROPE COSTS AND PROLONG ROPE LIFE

Thousands of wire rope users have found that the information packed in the pages of "Know Your Ropes" has made their work easier. It's full of suggestions on proper selection, application and usage of wire rope. It's easy-to-read and profusely illustrated. For your free copy, write — Wire Rope Sales Office, Wickwire Spencer Steel, Palmer, Mass.

WICKWIRE ROPE

CF&I & SUBSIDIARIES

A PRODUCT OF THE WICKWIRE SPENCER STEEL DIVISION OF THE COLORADO FUEL AND IRON CORPORATION

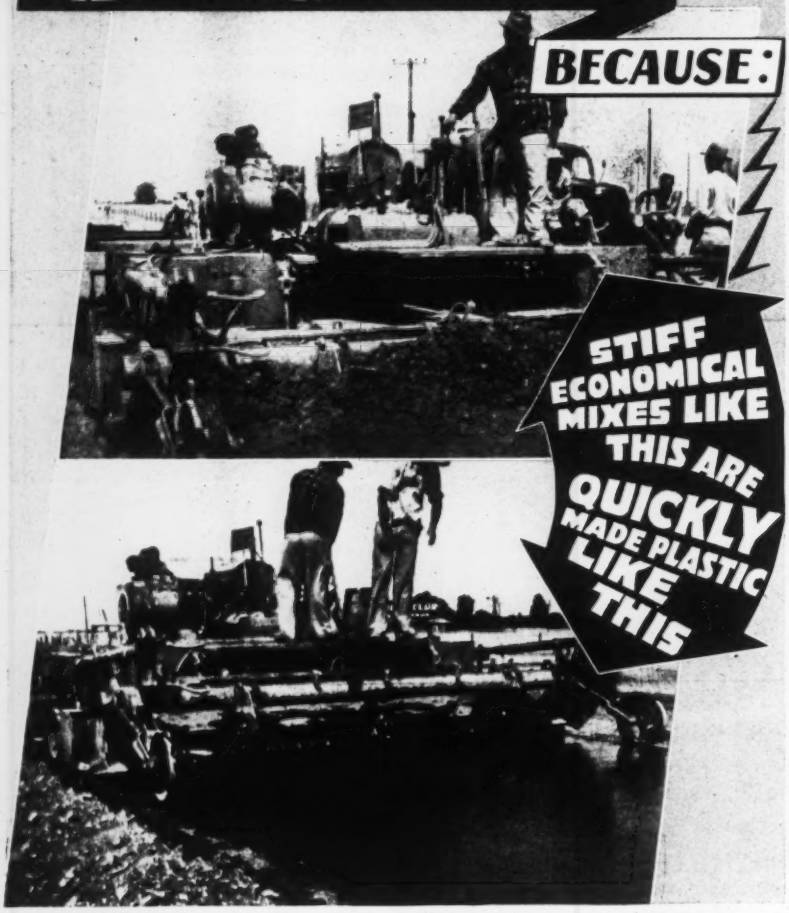
WIRE ROPE SALES OFFICE AND PLANT—Palmer, Mass. **EXECUTIVE OFFICE**—500 Fifth Avenue, New York 18, N. Y.

SALES OFFICES—Abilene (Tex.) • Boston • Buffalo • Chattanooga • Chicago • Denver • Detroit • Emlenton (Pa.) • Fort Worth • Houston • New York • Philadelphia • Tulsa

PACIFIC COAST SUBSIDIARY—The California Wire Cloth Corporation, Oakland 6, California

HIGHWAY ENGINEERS SPECIFY
and CONTRACTORS USE

The JACKSON VIBRATORY PAVING TUBE



DON'T BE LATE FOR '48!
GET THESE ADVANTAGES!

Important savings in cement can be made. Finishing progress is much more rapid. Concrete at forms and joints is puddled perfectly. Spreading costs reduced. Complete compaction and excellent finish obtained with less labor.

The JACKSON Paving Tube is perfectly adaptable to slabs 6" to 24" thick, without affecting the efficiency on single or two-course standard plain or reinforced concrete pavement construction and may be quickly adjusted from 10' to 25' widths in the field. Power Plant mounted on the Finisher has ample reserve power through entire frequency range of 3000 to 5000 VPM. Finger tip controls. Quickly and easily attached to any standard finisher — and can be attached to the rear of standard spreaders to advantage for vibrating the first course in thick slab construction. One of the best investments in equipment a paving contractor can make. See your Jackson distributor or write for further information NOW.

Manufactured by ELECTRIC TAMPER & EQUIPMENT CO. for
JACKSON VIBRATORS, INC. LUDINGTON, MICH.

under a council-manager charter recently adopted.

John F. Wilson, 57, consulting engineer for the Seattle Gas Co., died Jan. 13. He was for nine years chief engineer for the Washington department of public service. He attended Cornell University and the University of California.

O. F. Yount, superintendent of bridges of the 1st and 2d districts of the North Carolina Highway and Public Works Commission when he retired Jan. 1, has been awarded the commission's D. B. McCrary trophy for "outstanding and meritorious work in 1947." Yount's first job was with the Virginia Bridge and Iron Co. In 1913 he began building roads and bridges for counties in North Carolina. When the highway commission was created in 1915 he became bridge construction superintendent. In 1922 he left the commission to build roads and bridges in Edgecomb County, N. C., and returned in 1928, remaining until his retirement.

Kenneth C. Williams, formerly of Tacoma, has been appointed resident engineer for the Washington State Highway Department at Aberdeen. He succeeds George McLean, who was promoted to district maintenance engineer at Olympia. Williams has been with the department two year.

Lee M. Bush and **Roy L. Mullenix** have opened an office as Lee M. Bush & Co., Engineers—at 314 Colcord Bldg., Oklahoma City, Okla.

A. E. Johnson, office engineer and assistant chief engineer of the Arkansas Highway Department, has been made chief engineer succeeding the late W. W. Vass. Mr. Johnson is vice-president of the Southeastern Association of State Highway Officials.

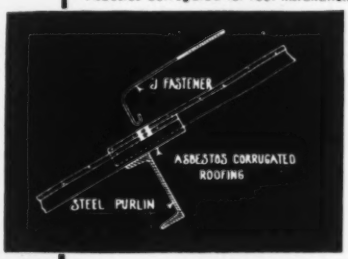
L. D. Howard, former highway department engineer, has been appointed chief airport engineer for the South Dakota Aeronautics Commission.

William J. McCrystle has been named acting construction engineer at Shasta Dam, Calif., succeeding **Irving J. Harris,** retired. McCrystle has been at the dam since 1938, except for three years service in the war. A graduate of the University of California, he also has worked four years in the Denver office of the Bureau of Reclamation. Harris joined the Bureau of

K&M "Century" ASBESTOS CORRUGATED

Sidewalls of this Diesel engine house of the Santa Fe at Barstow, Cal., were constructed of K&M "Century" Asbestos Corrugated.

Details of one of the new Top-Side Fasteners exclusive with K&M "Century" Asbestos Corrugated for roof installations.



NUT
STEEL WASHER
LEAD SEAL
AFTER LEAD SEAL IS SEATED BY TIGHTENING NUT, BREAK OFF EXCESS ROD, AND BEND LEAD APRON OVER EXPOSED END.
ASBESTOS CORRUGATED ROOFING
J FASTENER

for long rugged service, no upkeep

Because it lasts indefinitely and toughens with age. *K&M "Century" Asbestos Corrugated* is ideal for industrial building construction, typified by the *Santa Fe Railway's* Diesel engine house at Barstow, California.

The corrugations provide structural strength sufficient to stand up under severe vibrations. And "Century's" asbestos-cement composition resists fire, weather, rot, rust and galvanic action. No painting or upkeep is needed.

The new TOP-SIDE Fasteners, one of which is illustrated at left, are available only with K&M "Century" Asbestos Corrugated. They cut erection costs on roof installations over steel purlin construction. These fasteners are applied wholly from the roof surface . . . hence no scaffolding or workmen are required beneath the roof. Result: exceptionally low application costs. Write for full details.

Nature made Asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

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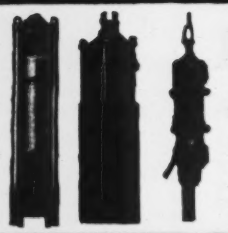
Williams Type **BUCKETS**

● Count on longer life and more efficient service...due to Wellman original **welded rolled steel construction.** You get the maximum digging power, and exceptional strength—without excessive weight! Specify Wellman, and you'll specify the best bucket for your purpose.

THE WELLMAN ENGINEERING COMPANY
7000 CENTRAL AVENUE • CLEVELAND 4, OHIO

McKiernan-Terry



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MK-237

McKIERNAN-TERRY CORPORATION MANUFACTURING ENGINEERS
13 PARK ROW, NEW YORK 7, N. Y.

Reclamation in 1909, resigning in 1916 to enter private consulting practice. He re-entered bureau employ in 1933 and joined the Shasta Dam staff in 1941.

Jean L. Vincenz, formerly of the office of the Chief of Army Engineers, Washington, D. C., has been appointed director of public works by the San Diego County, Calif., board of supervisors. For 10 years he was director of public works, manager of public utilities, and city engineer of Fresno, Calif. He had been active in the League of California Cities and is a Stanford University graduate. During the war he was in charge of maintenance and upkeep of the Army's real estate.

Gilbert E. Schmitz, for the last year a street engineer for Indianapolis, Ind., has been named airport engineer for the Aeronautics Commission of Indiana. He will prepare reports on site surveys and other airport engineering problems. He has had 11 years' experience with the Indiana State Highway Department, three years on road and railroad design at the Crane Naval Depot, Burns City, and was a captain in the Army Engineer Corps.

George Papageorge, consulting engineer of Atlanta, Ga., will be project engineer for the traffic survey at Memphis, Tenn.

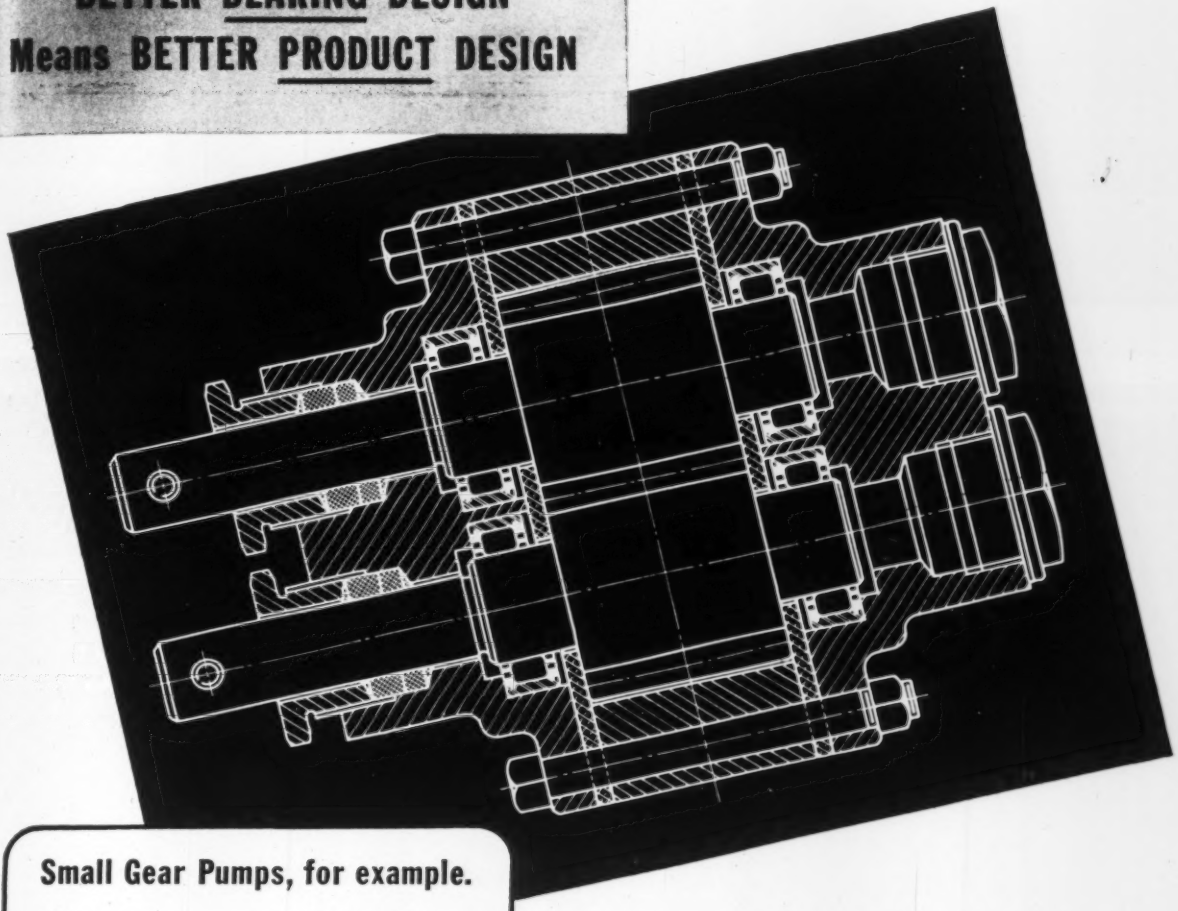
Thomas S. Cassedy, Union College, 1926, captain in the U. S. Engineer Corps, 1943-45, and experienced in sanitation, water supply and hydraulics, has become a partner of Whitman, Requardt and Associates, engineers, at 1304 St. Paul Street, Baltimore, Md.

John Robert Sancton, formerly with the Southern Mapping and Engineering Co. of Greensboro, N. C., and a veteran of Navy Seabees service, has been named an engineering aide in the municipal department of public works at Greensboro.

G. B. Gruenwell is chief engineer of a U. S. Geological Survey crew which is mapping the Morganton, N. C., area.

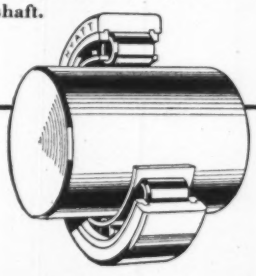
W. J. Heard, manager of Carey, Ohio, has been appointed city manager of Kinston, N. C., a newly-created post. An officer in the Army Engineers Corps during the war, he assumes his new duties Feb. 1. He received his civil engineering degree at Tri State College, Angola, Ind., and during the war was post engineer at the Greenville, Miss., Army Air Base and later in the Wilmington, N. C., District Engineers Office.

BETTER BEARING DESIGN Means BETTER PRODUCT DESIGN



Small Gear Pumps, for example.

Shorter distance between the shaft centerlines, without sacrificing shaft diameter—free floating shafts, permitting pressure balancing—and ease of assembly—are features which add to the overall compactness and efficiency of this design. Hyatt Hy-Load Roller Bearings made it possible because they have greater radial load capacity than any other bearing of the same standard size and type. And Hyatt design permits omission of the bearing inner race—thereby, either reducing the required bearing O.D. space, and/or permitting the use of larger shaft.



Better design and better performance—not only in gear pumps, large and small, but in virtually every type of industrial equipment—is a "matter of record" where Hyatt Roller Bearings are used. That's because fitting the bearing to the job—not the job to the bearing—is the Hyatt way of engineering.

Thus, when Hyatt Roller Bearings are built into a machine, you have the assurance that the bearing is planned, manufactured and applied for your specific requirements. Hyatt Engineering Service is at your disposal without cost or obligation. Address Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

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Elections and Activities

The Kentucky Society of Professional Engineers has elected Marion D. Ross, Frankfort, as its president, succeeding R. C. Page, Lexington. A. R. Spaulding, Hazard, and John A. Bitterman, Lexington, were named vice-presidents. C. S. Crouse, Lexington, was chosen secretary-treasurer for the 14th consecutive term.

Officers of the Association of Professional Engineers of New Brunswick are: R. M. Richardson of St. John, president; T. H. Dickson, Moncton, vice-president; C. D. MacDonald, of Sackville, and D. O. Turnbull, of St. John, councillors.

George Martin, Green Bay has been elected president of the Wisconsin Society of Professional Engineers. He succeeds W. A. Peirce, Racine. Other officers include Herb Moore, Milwaukee, first vice-president, and Edwin J. Kallevang, Madison, second vice-president. Re-elected were: O. J. Muegge, Madison, secretary, and L. M. Schindler, Appleton, treasurer.

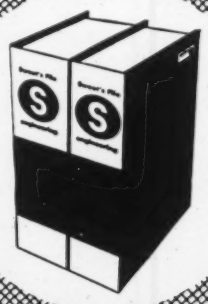
Anton Hulman, Jr., Terre Haute, has been re-elected chairman of the Indiana Flood Control & Water Resources Commission. Ralph Roessler, Marion, was re-elected vice-chairman. Clyde R. Black, Logansport, was reappointed executive secretary and David H. Harker chief engineer.

The Association of Professional Engineers of Nova Scotia has elected these officers: President, J. A. Russell, Sydney; vice-president, I. P. Macnab, Halifax; secretary-treasurer, J. D. Kline, Halifax.

New officers of the 50-year-old Louisiana Engineering Society are: W. Stone Leake, president; H. L. Lehmann, first vice-president; L. J. Cucullu, second vice-president, and John P. Fernandez, secretary-treasurer.

Officers of the North Dakota Reclamation Association are Oscar Lunseth, president; R. O. Young, 1st vice-president; C. S. Summers, 2d vice-president; Fred Hagen, treasurer; and J. I. Rovig, secretary.

Officers of the Wisconsin County Highway Commissioners Association are: J. J. Rusch, president; Edward Berkedal, vice-president; R. B. Kinney, secretary; and C. W. Thompson, treas.



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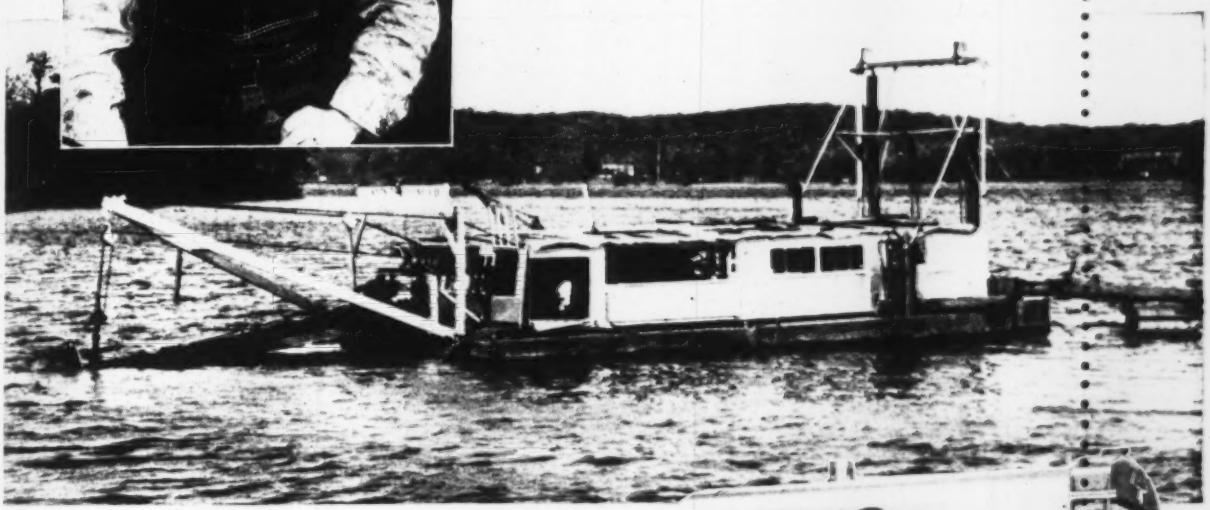
MAKING A MARSH INTO MONEY

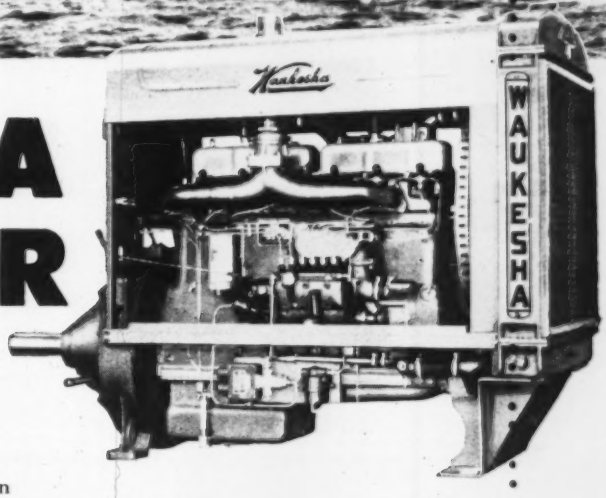
...with a Diesel driven dredge



WAUKESHA *Diesel* POWER

Model 148-DKU

Six cylinders, 5¼ in. bore x 6 in. stroke; 779 cu. in. displacement



Mr. VILBERT GUNYON looks pleased. Mr. Gunyon *is* pleased—with the way this dredge is filling in acreage on the shores of Lake Geneva, Wis. It is rapidly converting a marsh into resort property that is worth a million dollars or more.

The dredge is owned by the Gunyon Dredging Co., Elkhorn, Wis. It is the sand sucking type, and a 148-DKU Waukesha Diesel Power Unit drives both the pump and the cutter head. Mr. Gunyon is particularly pleased with this Waukesha Diesel. He thinks it's the best engine that he has ever run.

Installed in the dredge in the spring of 1946, this is one of the pilot models of the 148-DKU Waukesha Diesel. The unit in the picture shows the perfected design of the 148-DKU Diesel. It runs at full capacity with a remarkably clean exhaust. You'll be pleased, too, with a Diesel like this. It has a 7-bearing crankshaft with crankpins and main bearings hardened to 600 Brinell. Removable wet sleeve cylinders, hardened to 400 Brinell. Chrome silicon alloy intake and exhaust valves; both valve seats are Stellite inserts. 24-volt electric starting system. Why not find out all about it? Send for Bulletin 1414.

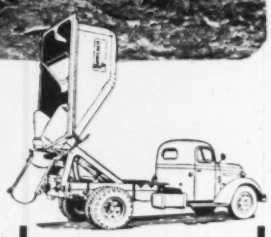
WAUKESHA MOTOR COMPANY • WAUKESHA, WIS. • NEW YORK • TULSA • LOS ANGELES

"No Segregation or Bleeding," Says Christiansen Brothers

Christiansen Brothers, general contractors in Salt Lake City, used Dumpcretes on several scattered foundation pours for the University of Utah. Through central-mixing and Dumpcrete-delivery, they found "much less confusion." Hauls ranged up to a mile. Rolf Christiansen says, "We found no segregation or bleeding and the units functioned in a thoroughly satisfactory manner."

Every day more and more contractors are recognizing the advantages of the Dumpcrete. It's delivering low-cost concrete from Vermont to Oregon, in Canada, Hawaii and Panama.

You'll want to learn about the economical Dumpcrete Concrete, too. Write now for the interesting, money-saving facts.



The Dumpcrete Body

Lightweight, watertight, loads fast, dumps fast or slow, places anywhere, costs less to buy and run. Ideal for hauling aggregate, coal and earth.

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*** Dumpcrete Concrete**

Is central-mix air-entrained concrete hauled and placed with the speedy, low-cost Dumpcrete. Provides top-quality, plastic, workable and non-segregating concrete, saving up to $1.00 per yard.

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MAXON CONSTRUCTION CO., INC.
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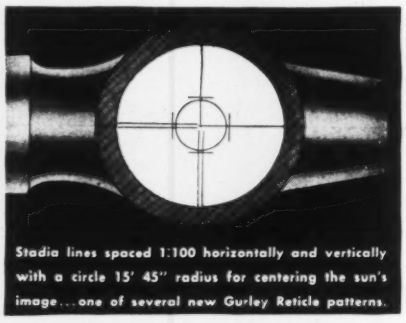
The New Gurley Transit Reticle

for More Accurate Pointing
Triangulation
Stellar Observation

Short stadia lines, spaced and ruled at precise intervals on optically flat glass, are easy to sight...do not extend over entire field of view nor interfere with cross-lines. Send for Bulletin No. 50. W. & L. E. Gurley, Union Plaza, Troy, New York.

Available only in Gurley Instruments



Stadia lines spaced 1:100 horizontally and vertically with a circle 15' 45" radius for centering the sun's image...one of several new Gurley Reticle patterns.

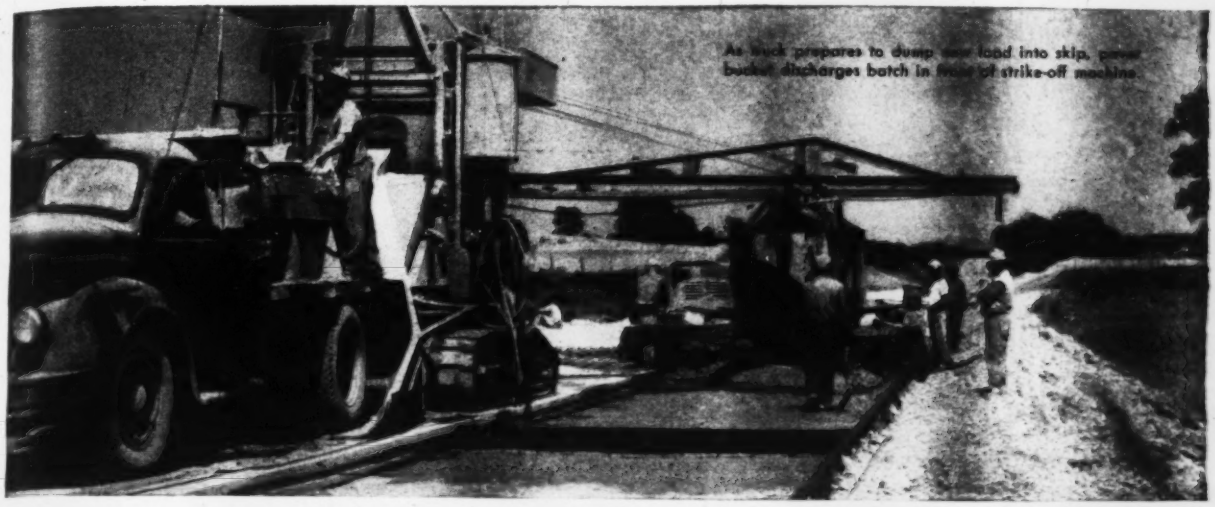
GURLEY *Surveying & Scientific Instrument Makers Since 1845*

Manufacturers' Activities

Current developments among manufacturers relating to expansion of services, shifts in personnel, and other changes, include the following:

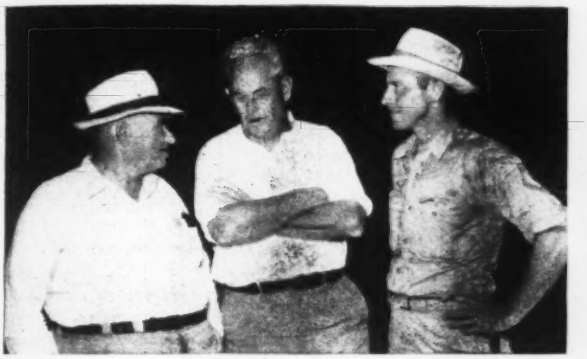
Home Office Changes—A. N. Morton and A. C. Fetzer have been elected vice-president of MACK TRUCKS, INC. . . . W. F. Mitchell, Wyandotte, Mich., has been appointed assistant vice-president of the PENNSYLVANIA SALT MFG. CO. . . . G. F. Clipsham is now assistant to the president of the LINCOLN ELECTRIC CO., Cleveland, Ohio. . . . Louis Siegel has been appointed manager of the aluminum division of the LEVINSON STEEL SALES CO. . . . A. F. Hutcheson has been named manager of the Anthracite district office of the ATLAS POWDER CO. at Tamaqua, Pa.

Sales Staff Changes—LE ROI CO. has opened a central district sales office at 6619 W. Mitchell St., Milwaukee, Wis., with Norman M. Sedgwick as manager. . . . Edwin H. Johnson is sales manager of the mining division of KENNAMETAL, INC., Latrobe, Pa. . . . H. H. Bullen of Chicago is now manager of western district electrical products sales for the AMERICAN STEEL AND WIRE CO. . . . D. A. Fassas has joined the sales force of PENNSYLVANIA REFINING CO., Cleveland, Ohio. . . . R. L. Cone, West Hartford, Conn., is sales head of the R. W. BLEILER EQUIPMENT CO., INC., in Litchfield Co., Conn., and in western Massachusetts. . . . John N. Harper will represent AMERICAN WHEELABRATOR & EQUIPMENT CORP., Mishawaka, Ind., in the Pittsburgh, Pa., territory. . . . C. W. Bird is at Shreveport, La., in charge of sales and service for the BIRD-ARCHER CO., New York, in the East Texas and southern Arkansas area. . . . Auwell Fogarty is assistant to Fred T. Wiggins, western region sales vice-president, UNIVERSAL ATLAS CEMENT CO. . . . New sales appointments in the Stamford, Conn., division of THE YALE & TOWNE MFG. CO., are: J. Frank Boxwell, manager trade sales; Raymond K. Watkins, manager of builders' hardware sales; Walter J. Cyr, manager of door closer sales; Edward Jones, manager of trade relations; John P. Dunphy, field sales manager; and H. Warner Hill, assistant manager, hardware sales. . . . J. P. Cantor is Cleveland, Ohio, district manager of the WHEELCO INSTRUMENTS CO., Chicago. . . . Melvin L. Kurtz is assistant sales manager, metropolitan Chicago territory, UNIVERSAL ATLAS CEMENT CO. . . . E. B. Maire, is sales manager of



As truck prepares to dump new load into skip, power bucket discharges batch in front of strike-off machine.

Philadelphia-Harrisburg Highway Undergoes Repair



John S. "Jack" Anderson (center), Hempt Bros. superintendent, chats with R. A. "Ike" Moore (left), resident engineer, Penna. Dept. of Highways, and Merle Elicker, Hempt Bros. foreman.

Taking a bite out of a hill. Dipper has a busy time loading shale into dump trucks and tractor-towed dump wagons.

Resurfacing, widening and relocation are three major repair jobs now taking place at various points along U. S. 422, through route from Philadelphia to Harrisburg. These recent construction scenes show one of the relocation jobs—a 4.6-mile double-barreled stretch of road between Lebanon and Myerstown. Contractor, Hempt Bros., Camp Hill, Pa. Bar mats, road joints, reinforcing bars and guard rail were furnished by Bethlehem.

Installing dowel caps on bar-dowel unit. Joint is designed to minimize load-transfer problems caused by heavy wheel loads.

With finishing machine standing by, Bethlehem Hinged Bar Mat is lifted into place. Two men handle mat with ease.

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Wire Rope and Strand • Hollow Drill Steel
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BETHLEHEM STEEL

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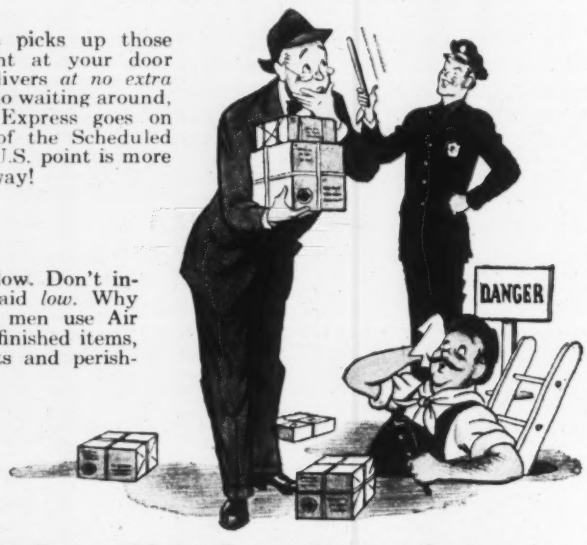
"No jay-walkin' here! Gotta get to the airport? To Air Express those packages? My poor friend — haven't you heard?

"Air Express picks up those packages right at your door here, and delivers *at no extra cost*. There's no waiting around, because Air Express goes on every flight of the Scheduled Airlines. No U.S. point is more than hours away!



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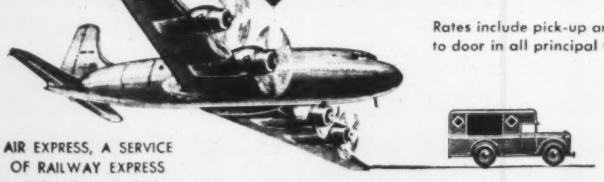

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the Boston, Mass., Philadelphia, Pa., Pittsburgh, Pa., Birmingham, Ala., New York, N. Y., Detroit, Mich., Cleveland, Ohio, and Chicago, Ill. offices of GENERAL CONTROLS Co., Glendale, Calif. . . . William Townsend has been named general sales manager of the PENNSYLVANIA FLEXIBLE METALLIC TUBING Co., Philadelphia, Pa. . . . R. W. Head is district sales manager at Dallas, Tex., for MARION POWER SHOVEL Co.

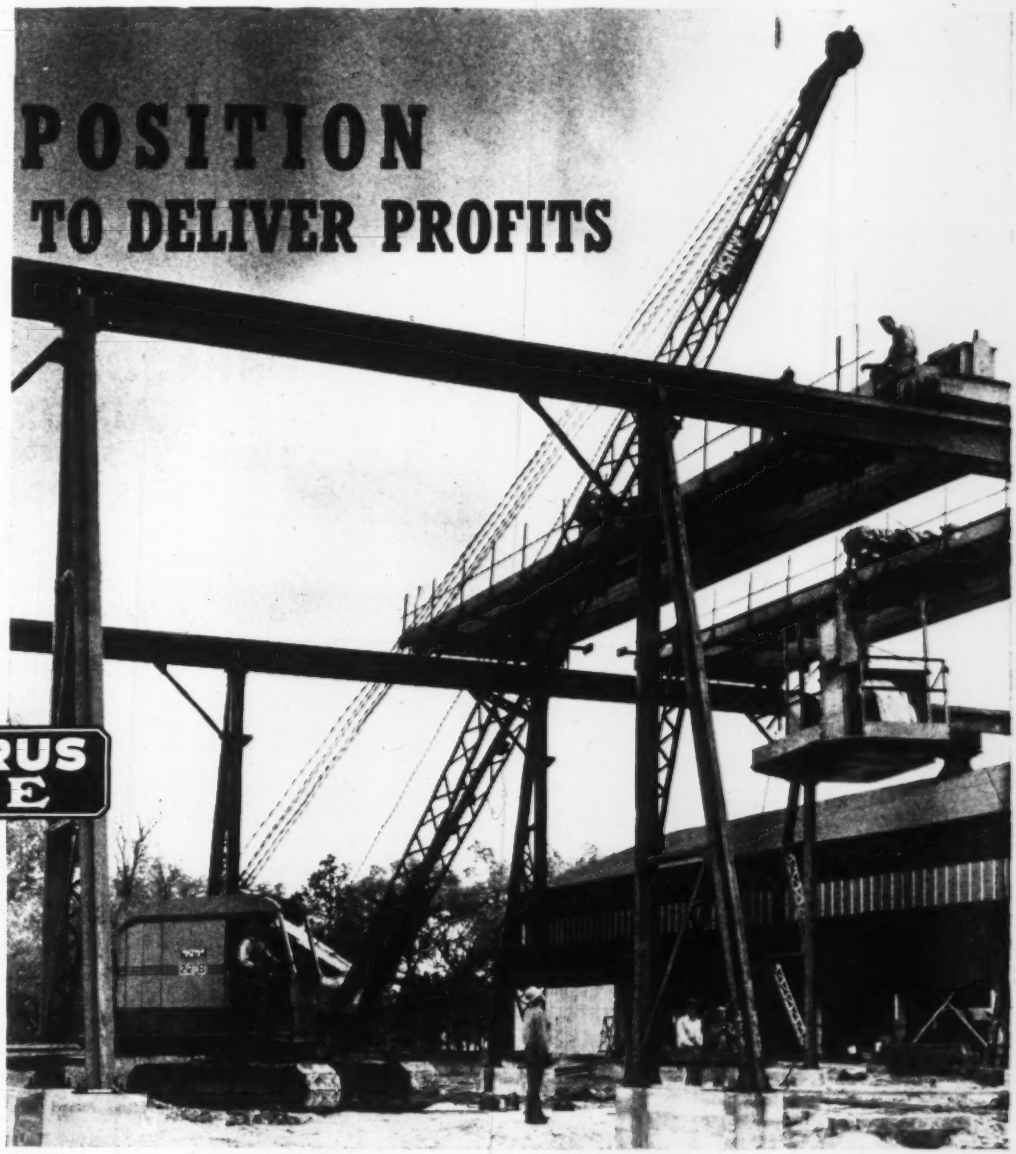
Dealer Appointments — HARDINGE Co., INC., YORK, Pa., has appointed the AUTO-FILTRATION Co. of Montreal sales agent for Quebec, the maritime provinces and Newfoundland. . . . Sidney C. Small of Los Angeles, Calif., is sales engineer of the A. P. SMITH MFG. Co., East Orange, N. J., in the Arizona and southern California territory. . . . THE ISLAND SUPPLY Co., Grand Island, Neb., has been appointed distributors in central Nebraska for HOBART BROTHERS Co., Troy, Ohio. . . . INDUSTRIAL AIR PRODUCTS Co. has been appointed exclusive electrode distributor in Oregon for the WILSON WELDER & METALS Co., INC., New York.

Personalities—Pardee H. Frank, service manager of THE TIMKEN ROLLER BEARING Co. retired Feb. 1 after 27 years of continuous service, and Wm. A. Fowler, general manager of the Columbus plant has also retired. . . . L. B. McKnight and O. W. Carpenter have been elected directors of CHAIN BELT Co. . . . AIR REDUCTION PACIFIC Co. has appointed these vice-presidents: L. A. Hamilton, Seattle; E. W. MacCorkle, Jr., Portland, Ore.; H. W. Saunders, San Francisco; and H. A. Hoth, Los Angeles. . . . James M. White has resigned as vice-president of manufacturing, ALLIS-CHADMERS MFG. Co., Milwaukee, Wis., but will remain for six months in an advisory capacity to President Walter Geist. . . . Eugene W. Stetson, Jr., of Green Farms, Conn., has been elected a director of THE YALE & TOWNE MFG. Co. . . . Wm. J. Reardon of REARDON INDUSTRIES, Cincinnati, Ohio, has been appointed a trustee of the OHIO TURNPIKE COMMITTEE.

Deceased—Carl Crozer, IOWA MFG. Co., Cedar Rapids, Jan. 29. . . . C. I. Auten, 65, former manager of sales, TRUSCON STEEL Co. at Atlanta, Ga., Jan. 31. . . . Wm. J. Hamilton, 80, secretary and director, HENDRICK MFG. Co., Carbondale, Pa., Jan. 27. . . . Richard H. Goode, president DUNBAR & SULLIVAN DREDGING Co., Detroit, Mich., Jan. 8. . . . John S. Boyd, 59, vice-president and director, THE GALION IRON WORKS & MFG. Co., Galion, Ohio, Jan. 13.

Miscellany—REPUBLIC STEEL CORP., Cleveland, Ohio, has created a public relations department, according to C. M.

In POSITION TO DELIVER PROFITS



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HIGH LIFTING capacity per pound of weight, and ability to inch loads accurately into place are two big reasons for the outstanding lifting crane service provided by the Bucyrus-Erie ⅜- to 2½-cu. yd. machines.

An independent boom hoist enables the operator to change the boom angle at any point in the cycle and makes possible the delicate positioning of loads that means efficient, economical crane operation. Positive controls make raising and lowering of the boom safe, sure and simple. Unusual balance and stability combined with easy, certain control of swing, hoist and propel increase working speed to produce the fast, effective crane service you need.

Top-flight crane performance is only one of the many features which put the Bucyrus-Erie ⅜- to 2½-cu. yd. line out front in the field. See your Bucyrus-Erie distributor for more information on these outstanding machines.

BUCYRUS-ERIE CO.
SOUTH MILWAUKEE, WISCONSIN

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City.....*Zone*....*State*.....

White, president. Heading the new department is E. S. Bowerfind, who for the last 14 years has been associated with HILL AND KNOWLTON of Cleveland. . . . A total of 172,405 new CHEVROLET "Advance-Design" trucks were sold before Jan. 20, and are now in use. . . . The formation of an industrial and utility section of BORG-WARNER INTERNATIONAL CORP. is announced, with headquarters at 321 West Layfayette Ave., Detroit, Mich. . . . A proposal to change the name of THE AMERICAN ROLLING MILL CO. to ARMCO STEEL CORP., will be submitted to shareholders on April 15. . . . BROWN INSTRUMENT Co. has opened a new district office at 922 Dermon Bldg., Memphis, Tenn. . . . The 40th annual convention of the AMERICAN CONCRETE PIPE ASSN. will be held in New Orleans, La., March 11-13. . . . MINNEAPOLIS-HONEYWELL REGULATOR CO. has opened a new branch office at 1514 E Central, Wichita, Kan., with Lynn H. Johnson, Jr., as manager. . . . C. H. Rieman is manager of the GARDNER-DENVER CO. branch office in Duluth, Minn., and G. B. Daigh, manager in Washington, D. C. . . . New MACK TRUCK appointments are: C. E. Cole, district manager in charge of the Los Angeles branch, at 1501 South Central Avenue; Lawrence D. McLean, district manager in charge of the Reading, Pa., branch, at 1212 Moss Street; T. H. Jones, district manager of the Charlotte, N. C., branch, at 1400 South Mint Street; and William Dudde, district manager of the Bronx, N. Y., branch, Leggett Avenue and Barry Street, N. Y. City.

New Engineering Books

(*Continued from page* 96)

WHO'S WHO IN ENGINEERING—Sixth Edition—2,357 pp. Lewis Historical Publishing Co., New York City. $15.

MANUAL OF STRUCTURAL DESIGN—By Jack Singleton. 336 pp. H. M. Ives & Sons, Topeka, Kansas. $6.

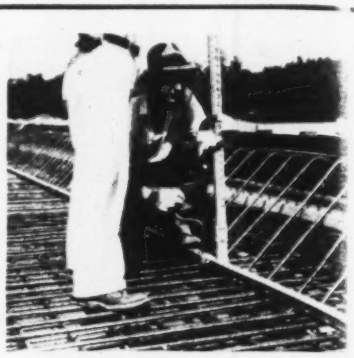
BEST'S SAFETY DIRECTORY OF 1948—2nd Edition—494 pp. Alfred M. Best Company, 75 Fulton St., New York 7. $5.

HEATING AND VENTILATING'S BUYERS DIRECTORY—1948 Edition—320 pp. The Industrial Press, New York 13, N. Y. $1.

HEATING AND VENTILATING'S ENGINEERING DATABOOK—First Edition—By Clifford Strock. 570 pp. The Industrial Press, New York 13. $7.

A.S.T.M. STANDARDS: PART II, NONMETALLIC MATERIALS—CONSTRUCTIONAL—1947 Supplement—463 pp. American Society for Testing Materials, Philadelphia 3, Pa.

PROCEEDINGS NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS—



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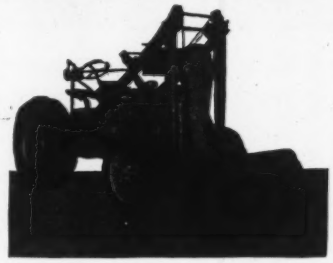

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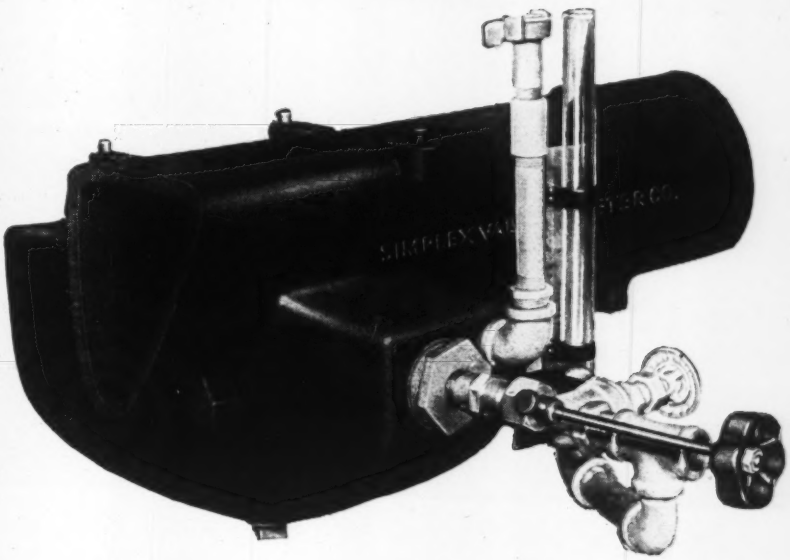

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26th Annual Meeting. 194 pp. T. Keith Legare, Executive Secretary, Drawer 1404, Columbia, S. C.

WATER WELL HANDBOOK—First Edition—199 pp. Missouri Water Well Drillers Association, Rolla, Missouri.

THE NATIONAL PAINT DICTIONARY—Third Edition. By Jeffrey R. Stewart. 703 pp. Stewart Research Laboratory, Box 173, Ben Franklin Station, Washington, D. C. $7.50.

THE RIVER PLATE REPUBLICS—By Bertis de Sherbinin. 276 pp. Coward-McCann, Inc. New York. $4.

THEORY OF LIMIT DESIGN—By J. A. Van Den Broek. 144 pp. John Wiley & Sons, New York. Chapman & Hall, London. $3.50.

ROAD TO THE SEA—The Story of James B. Eads and the Mississippi River. By Florence Dorsey. 340 pp. Rinehart & Co., New York and Toronto. $4.

TRANSPORTATION IN AMERICA—391 pp. Association of American Railroads, Washington, D. C.

APARTMENT HOUSES—By J. H. Abel and F. N. Severud. 280 pp. Reinhold Publishing Corporation, New York 18. $10.

PROCEEDINGS OF THE SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS—Vol. V, No. 1—136 pp. Addison-Wesley Press, Inc., Cambridge 42, Mass. $6.

Reports and Pamphlets

EVAPORATION FROM WATER SURFACES IN CALIFORNIA—Bulletin No. 54—Division of Water Resources, Department of Public Works, Sacramento, Calif.

HERE'S A BETTER WAY TO BUILD—National Retail Lumber Dealers Association, Washington 6, D. C. $1.

STANDARD WELDING SYMBOLS AND RULES FOR THEIR USE—Prepared by American Welding Society Committee on Symbols, 33 West 39th Street, New York 18. $.50.

RESERVOIR SEDIMENTATION IN THE SACRAMENTO-SAN JOAQUIN DRAINAGE BASINS CALIFORNIA—Special Report No. 10. Soil Conservation Service, U. S. Department of Agriculture, Washington 25, D. C.

SOIL FREEZING AND FROST HEAVING WITH SPECIAL APPLICATION TO ROADS AND RAILROADS—By Gunnar Beskow. With a special supplement of progress from 1935 to 1946. The Swedish Geological Society. Translated by J. O. Osterberg. Published by the Technological Institute Northwestern University, Evanston, Ill. $3.

ALEXANDRIA, LOUISIANA, STREET AND HIGHWAY PLAN—Prepared for the Louisiana Department of Highways and the Public Roads Administration by H. W. Lochner & Co., Chicago, Ill.